COMPASS® FOR PRESSURE
Calibration Software
User's Manual

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ABOUT THIS MANUAL

Manual Conventions

This manual provides the user with the information necessary to set up and run **COMPASS® for Pressure.** It also includes a great deal of additional information provided to help you optimize **COMPASS** use and take full advantage of its many features and functions.

Before using the manual, take a moment to familiarize yourself with the Table of Contents structure: Sections 3, 4 and 5 should be read by all first time **COMPASS for Pressure** users. Certain words and expressions have specific meaning as they pertain to **COMPASS**. The Glossary, Section 6, is useful as a quick reference for exact definition of specific words and expressions as they are used in the manual. Cross references are used extensively to direct you towards additional information on a topic. Cross references are generally placed next to the subject they reference to, in parentheses with the reference's section number alone or with Table or Figure. For example, (11.3.2), references a section; (Table 4) references a table and (Figure 2) references a figure.

For those of you who don't read manuals, go directly to Installing Section 2 to install COMPASS, then Section 2 to get started and Section 3 for a summary of operating principles. Later … when you have questions or start to wonder about all the great features you might be missing, get into the manual.

[ ] indicates **COMPASS** menu, tab or button selections (for example **[Data])**. Menu or tab selection paths are always described hierarchically from highest to lowest level. For example: **[Tools]**, **[Options]**, **[Piston Gauge]**).

< > indicates **COMPASS** text displays such as screen names, field names, prompts, warnings and instructions. For example: **<Enter user ID>).**

File names are designated in quotation marks when they do NOT include a file extension. For example: **"dat" file** or ***.dat**.

COMPASS functions and features are identified in bold and capitalized, for example General Toolbar or DUT Definition Editor.

(CAUTION) is used in manual to identify user warnings and cautions.

(NOTE) is used in the manual to identify operating and applications advice and additional explanations.

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NOTES

1. INTRODUCTION

Welcome to **COMPASS® for Pressure**, the complete pressure calibration software package. **COMPASS for Pressure** is designed to supply the missing link needed to get from individual automated hardware components to a complete, automated pressure calibration system. Using **COMPASS FOR PRESSURE**, you can define characteristics of various devices under test (DUT), create any number of calibration scenarios run tests, analyze test data and generate reports without ever leaving the program or you can export test data for analysis using other applications. **COMPASS**'s flexible approach makes it easily adaptable to a wide variety of hardware and allows you to adjust the level of automation for the level of automation supported by your hardware and for many different tasks. In addition, the access level of users can be adjusted to support administrative control of the program.

COMPASS for Pressure is available in Basic and Enhanced versions with different levels of features and functions. Both the Basic and Enhanced versions can be purchased with a single user or site license. See Section 1.1 for a summary of the difference between the Basic and Enhanced versions and Section 1.2 concerning the rights or single user and site licenses.

1.1 COMPASS FOR PRESSURE BASIC AND COMPASS FOR PRESSURE ENHANCED

COMPASS for Pressure is available in Basic and Enhanced versions. The **COMPASS** opening screen, the title at the top of the main screen and the **[Help]**, **[About]** menu choice all identify the version of **COMPASS** that is running.

Table 1 summarizes the differences between **COMPASS for Pressure** Basic, **COMPASS for Pressure** Enhanced and **COMPASS** for PPC/RPM.

In many cases the setup features of **COMPASS for Pressure** Enhanced are available in **COMPASS for Pressure** Basic. However, a test cannot be executed with the devices or tests setup with features that are not supported in **COMPASS for Pressure** Basic. Attempting to use **COMPASS for Pressure** Enhanced features in **COMPASS for Pressure** Basic results in an error message.

Table 1. Features of **COMPASS for Pressure** Basic and Enhanced Versions

	FEATURE DESCRIPTION	COMPASS FOR PRESSURE ENHANCED	COMPASS FOR PRESSURE BASIC	COMPASS FOR PPC/RPM
1.	**Create Test Definitions** Tests define the detailed test script that **COMPASS** follows when running a test. The test is the procedure used by **COMPASS** to calibrate or test a DUT.	●	●	●
2.	**Link Tests to DUTs** Linking a test to a DUT assures that when a DUT is selected, it will be tested with the test script that has been assigned to it.	●	●	●
3.	**Customizable Reports** Fully customizable reports that can be saved in MS Word format.	●	●	●
4.	**Automated Support of DHI Products** All remotely accessible features in products manufactured by **DHI** are controllable by **COMPASS**. In most cases, this allows complete test automation.	●	●	●

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	FEATURE DESCRIPTION	COMPASS FOR PRESSURE ENHANCED	COMPASS FOR PRESSURE BASIC	COMPASS FOR PPC/RPM
5.	**Define and Maintain DUTs** DUT definitions store the comprehensive identifying characteristics of a device under test and the fundamental output to pressure relationship that **COMPASS** will use to determine the final output pressure.	●	●	●
6.	**Delimited, ASCII Character Test Files** Comprehensive test parameters and results are saved to delimited, ASCII character files that are easily downloaded into other applications such as Microsoft Excel.	●	●	●
7.	**Separation of Reference Control and Measure** Two different devices can be used for reference control and measurement within a test. For example, a low accuracy control device can be combined with a high precision reference measurement device to automate a test.	●	●	
8.	**Manual Test Support** Manual tests allow a user to run automated devices independently of a specific test definition. Direct control of devices is supported throughout the test. Test points can be taken one at a time or automatically at a timed interval.	●	●	
9.	**Test Output to Database** **COMPASS** test data can be logged to an MS Access® database in addition to or instead of the delimited ASCII data file. Features in **COMPASS** allow the database data to be viewed, searched and reported. Existing delimited data files can also be added to the database if desired.	●	●	
10.	**Advanced Plotting** Fully customizable plots can be created for general use or insertion into a report. Plot colors, types, labels, points and scaling are amongst the extensive list of customizable plot features. In addition 3D scientific plots can be used to generate information rich surface plots.	●	●	
11.	**Piston Gauge Support** Piston-Cylinder, Mass Set and Mass Bell information can be defined and maintained by **COMPASS**. Using the defined elements, **COMPASS** solves the pressure equation as necessary for the type of Piston Gauge. All ambient and device conditions can be read by **COMPASS** real time from any device with a **COMPASS** supported interface. **COMPASS** operates in mass to pressure and pressure to mass modes. Remote automation of **DHI** PG7000 piston-gauges is also provided. **COMPASS** reads and sets the desired pressure target in the PG Terminal and prompts the **COMPASS** user for the required mass load.	●	●	
12.	**Support Device Database** An extensive database of device setups for **COMPASS** are maintained by **DHI**. Periodic updates of this database are available for download. As a result, adding a new device does not always require setting up remote commands to allow complete automation of the device. In many cases only the device's unique identifying information (serial number) and interface settings (IEEE-488 address) are required to setup the device.	●	●	
13.	**Device Macro Access** Macros can be used to manipulate the fundamental output of devices as needed to achieve the desired final output. This feature is provided to manipulate outputs that do not conform to one of **COMPASS**'s built-in raw output to final output conversions. Macros can also be used to create and manipulate remote commands for devices. Not all devices use simple ASCII commands. Some devices require special formatting with non-printable characters. This type of device would require a macro.	●	●	
14.	**Enhanced Remote Interface Support** Interfaces other than RS232 and IEEE-488 are available to increase the support of automated control and measurement equipment. Multiple commands are available to separately initialize, read and control a device.	●	●	

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	FEATURE DESCRIPTION	COMPASS FOR PRESSURE ENHANCED	COMPASS FOR PRESSURE BASIC	COMPASS FOR PPC/RPM
15.	**Tracking of Setup Changes** All device and metrological element setups are tagged with the date of the last edit and the user logged in at the time of the edit.	●	●	
16.	**Network Support** Multiple **COMPASS** users can simultaneously share the **COMPASS** configuration database. Tests and Device Definitions created on one PC can be accessed on all other PCs.	●	●	
17.	**User Rights Management** Rights can be assigned to different users in **COMPASS** to prevent access to portions of the program. This allows **a** user with administrator rights to setup the metrological aspects of **COMPASS** and restrict access to these setups. For example, an administrator can change the effective area of a piston-cylinder after recalibration. All **COMPASS** users can use the changed piston-cylinder setup but not be able to change the setup themselves.	●	●	
18.	**Calibration Tracking** Calibration date information is available in reports for all devices setup in **COMPASS**. Options in **COMPASS** prevent devices that are out of calibration from being used in tests.	●	●	
19.	**Automated Support of non-DHI Devices References** Any pressure controlling or measuring device with a remote interface supported by **COMPASS** can be used to automate the testing process. This includes non-**DHI** pressure references.	●		
20.	**Advanced DUT Support** DUTs that support outputs other than DUT pressure can be setup and used to supply other outputs and control in different parts of **COMPASS**. This is useful for DUTs that output temperature or can control pressure. Advanced DUTs can also be configured to provide reference pressure. Consequently, a DUT can be setup one time and used to perform many different functions in **COMPASS**.	●		
21.	**Use of Multiple References Within a Single Test** The range and/or specifications of some DUTs may require the use of more than one reference device to complete the calibration process. For each change, **COMPASS** allows valves to be adjusted and macros to be executed to allow fully automated changing of reference devices.	●		
22.	**Test Macro Access** Test Macros allow complete control of the testing process. A Test Macro can, for example, be used to adjust external valves in a specific sequence between test points or as part of a reference or controller change.	●		
23.	**Include Temperatures and Line Pressures in a Test** The basic pressure sequence can be repeated at multiple line pressures (with line pressure setting) and pressure/line pressure sequence can be repeated at multiple temperatures (with temperature control).	●		

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1.2 COMPASS SINGLE USER AND SITE LICENSE

COMPASS for Pressure Basic and **COMPASS for Pressure** Enhanced can be purchased with either a single user or a site license.

A single user license allows only one copy of **COMPASS** to run per purchased single user license at an organization. Each copy of **COMPASS** must use its own database or be the only copy of **COMPASS** using a shared database. Multiple single user licensed copies of **COMPASS** cannot use a common database at the same time.

A site license allows **COMPASS** to run on up to 10 computers belonging to one organization at one site. Up to 10 copies of **COMPASS** can access the database simultaneously. This allows multiple **COMPASS** stations to share the same **COMPASS** setup at the same time.

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2. INSTALLING COMPASS

2.1 OVERVIEW

COMPASS for Pressure is delivered on a CD ROM. The original installation must be made off the CD ROM. Subsequent upgrades can be made by download from the **DHI** website, www.dhinstruments.com. With the exception of the installation initialization, the installation program prompts and options are the same in either case. When the internet download of **COMPASS** is executed, the installation program immediately executes to guide the installation process. When installing from a purchased CD ROM, the CD's installation program automatically runs. To install **COMPASS**, choose the **[Install COMPASS for Pressure]** option.

To install from CD ROM:

❶ Insert the **COMPASS for Pressure** CD into the CD drive. If the auto run feature is enabled on the PC, the setup application runs automatically.

❷ If the setup program does not run after 10 seconds, press the Windows **[Start]** button and select **[Run]**.

❸ In the Run dialog box, type **d:\setup** or **f:\setup**, depending on the drive letter of the CD drive of the installation disk. Select **COMPASS for Pressure** from the list of applications and follow the installation prompts to install the program.

2.1.1.1.1.1 OR

❶ Insert the **COMPASS for Pressure** CD into the CD drive.

❷ Use the Add/Remove Programs feature in the Windows Control Panel**.** Press the Windows **[Start]** button and select **[Settings]** followed by **[Control Panel]**.

❸ Double-click the **[Add/Remove Programs]** icon and click the **[Install]** button. Follow the prompts to install **COMPASS**. Select **COMPASS for Pressure** from the list of applications and follow the installation prompts to install the program.

When the software installation is complete, a new Windows group is created to hold the **COMPASS** program. To run the program, select it by pressing the Windows **[Start]** button, selecting the **[Programs]** sub-menu followed by the **[COMPASS for Pressure]** group. Click the **[COMPASS for Pressure]** icon to start the program.

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2.2 SYSTEM REQUIREMENTS

COMPASS for Pressure is an application designed for Windows 32 bit operating systems. This includes all 32 bit versions of Windows. Although any computer running one of these operating systems has the basic requirements to run **COMPASS**, it is recommended that the following minimum configuration be used:

Windows®, Versions greater than 95

500 MHz, Pentium processor

128 MB RAM

50 MB free hard disk space

As of the printing of this manual, **COMPASS** supports only *CEC* and *National Instruments* IEEE-488 interface cards. One of these cards must be installed on the PC to allow **COMPASS** to communicate with instruments via IEEE-488.

2.3 UNINSTALLING COMPASS FOR PRESSURE

To uninstall **COMPASS**, use the **Add/Remove Programs** feature in the Windows **Control Panel** and select **COMPASS for Pressure**. In both cases, a series of prompts must be followed in the application removal program to uninstall **COMPASS**. All installation files and registry updates are removed. Data directories created by running **COMPASS** are not removed by uninstalling. It is up to the user to manually remove these data directories. By default this directory is "C:\Program Files**COMPASS for Pressure**\Data". The application removal program always displays a message indicating **COMPASS** was not completely removed when executed after new Data Files have been created. Any file management tool such as Windows Explorer can be used to remove these data directories.

2.4 UPGRADING FROM COMPASS FOR PPC/RPM

All Data Files, DUTs and tests created with **COMPASS for PPC/RPM** can be used in **COMPASS for Pressure**. Data Files can be directly accessed like native **COMPASS for Pressure** Data Files. Prior to using DUT and Test files, use the **[Tools]**,**[File Upgrade Wizard]** feature to convert the **COMPASS for PPC/RPM** files into the format required by **COMPASS for Pressure**. The original **COMPASS for PPC/RPM** files are not modified and can still be used with **COMPASS for PPC/RPM** after the upgrade process completes.

2.5 NETWORK/SHARED INSTALLATIONS

The **COMPASS** main program and any of its components can run from a network drive. However, the program must be installed on each local PC first. Never directly install **COMPASS** on a network drive. After the installation on a local PC, the core **COMPASS** files and setup database files can be copied to the network drive. To avoid issues associated with upgrading **COMPASS**, it is best to only share the **COMPASS** setup database files. Having these files in a shared location allows all **COMPASS** users on the network to use the same hardware setup. User rights should be assigned to limit access to sensitive **COMPASS** data, such as reference calibration information and Test Definitions (see 24.3, **[Database], [Users]**). The steps below describe this procedure.

Only site license versions of COMPASS will allow multiple copies of COMPASS to use the same database at the same time. Non site license versions of COMPASS will not run if another copy of COMPASS is using the database.

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COMPASS options are stored locally on each PC. Users must manually choose the same options on the PCs that will use COMPASS. It is a good idea to use user rights to limit access to the options to avoid inconsistencies between COMPASS stations.

The same process used to setup COMPASS in a network environment can be used to transfer a COMPASS setup from one PC to another PC. The only difference is that instead of copying files to a network drive, the files should be copied directly to the second PC. If the files cannot be transferred over a network, the data must be transferred via floppy disk or writeable CD.

1. Install **COMPASS** for Pressure on the first PC.
2. Determine a directory on the network that is accessible to all PCs that will be running **COMPASS**. Read and write access is required. Copy the **Compsetp.mdb** and the CompData.mdb files to this directory. These files are found in the COMPASS installation directory and represent the configuration and test data database files respectively. By default **COMPASS** is installed to "C:\Program Files\COMPASS for Pressure".
3. Create sub directory folders called: Data, Template, and Report on the network. These directories should be used as the default storage location for data files, report templates and reports. Locate the **COMPASS** installation directory on the local PC and copy the contents of the Data, Template and Report directories to the corresponding folder on the network.
4. Run **COMPASS** and choose the **[Database]**,**[Setup]** menu choice (see 24.2, [Database], [Setup]). Specify the network location of the configuration database and the test data database files. Click the entry field and browse the network if necessary. Also specify a unique **<Station Identification>** value. Make sure that only alpha numeric characters are used in the **<Station Identification>** field. Press **[OK]** to accept the changes.
5. Select **[Tools]**,**[Options]**,**[Data File]** and specify a network directory for the **<Root data file directory>**.
6. Specify any other relevant program options, default values, initialization options, file and grid selections, ect. It is important to keep the program options consistent to avoid confusion between **COMPASS** users.
7. Run the **COMPASS Report Editor**. Select **[Tools]**,**[Options]** menu choice to display the Report Editor options. On each tab there is a path related entry. Specify the proper network path in each entry then save the options and close the Report Editor. Use the network sub directories Data, Template and Report created in step 3.
8. For all other PCs, install **COMPASS** then repeat steps 4 to 7. It is important to insure that all program options are the same to prevent confusion when users change **COMPASS** work stations. However, having the same options is not required for a valid Network setup.

As a shortcut to selecting **COMPASS** options on each PC, a registry file can be generated on the first PC and imported into the registry on other PCs.

1. Run the Windows Registry Editor on the first PC in which **COMPASS** was setup. Press **[Start]**, **[Run]** and enter "Regedit" then press [Enter]. If an error occurs enter "C:\Windows\Regedit" and retry. The Windows Registry Editor should display.
2. Select the COMPASS registry key on the left of the display by navigating to the location: HKEY_LOCAL_MACHINE\SOFTWARE\DH Instruments\COMPASS for Pressure
3. Select **[File]**, **[Export]** and enter the file name "COMPASS.reg" and specify the **COMPASS** network path and press **[Save]**. This saves all **COMPASS** settings to the COMPASS.reg file. If the PC is running Windows XP and other PCs that use **COMPASS** will not be running Windows XP, select the "Win9x/NT Reg File Type" in the **<Save as type>**. This generates registry files that are reverse compatible.
4. Select the Report Editor registry key and create a second registry file. The Report Editor key is: HKEY_LOCAL_MACHINE\SOFTWARE\DH Instruments\COMPASS Report Editor
5. Repeat step 3 to save the Report Editor registry file. This time use the file name "Report.reg"

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6. To import these settings on another PC, again run the registry editor. This time select **[File]**, **[Import]** and select the previously created registry file "COMPASS.reg" from the COMPASS network directory. After this file is imported, again select **[File]**,**[Import]** and select the "Report.reg" file to import the Report Editor options.
7. At this point all **COMPASS** settings from the first PC have been copied to the target PC. However each PC requires a unique Station ID value. This field must be changed manually by running COMPASS and selecting the **[Database][Setup]** menu choice. Enter a unique value in the **<Station ID>** field
8. Repeat steps 6 and 7 for all PCs that will use **COMPASS**.

2.6 UPDATING EXAMPLE SETUPS

Many practical examples of **COMPASS** setups are available for download from the DH Instruments website, www.dhinstruments.com. The examples allow **COMPASS** users to quickly setup DUTs, support devices and piston gauge platforms. To use the existing examples, activate one of the **Device Editors** from the **[Setup]** menu. Select a manufacturer and model on the **[Header]** tab then press the **[Find Previous Setup]** button (see 4.3.3, [Header] Tab). Example setups that match the selected manufacturer and model are available for selection. Select the setup that best describes the device. Edit the range and communications settings as required for the active device.

Follow the steps described below to update the current list of examples.

- Download the latest copy of the **default.mdb**. The file should be copied to the installation directory of **COMPASS for Pressure**.

- Select the **[Database]**,**[COMPASS Database Maintenance Tool]** menu choice (see 24.5).

- Select the downloaded example database file, **default.mdb** if it is not already selected as the **<Merge Database>** file.

- Select **<Example Device Setups>** from the **<Data to View>** list. All current examples in the example database and in the active database will display (see **Figure 195**). Select the individual examples to update in the **<Merge Database>** list. Alternatively press the **[All]** button in the **<Merge Database>** frame to quickly select all examples.

- Press the down arrow to update the current database with the selected examples.

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3. OPERATING PRINCIPLES

3.1 OVERVIEW

COMPASS for Pressure is an application program intended to automate pressure test and calibration processes to the extent supported by the available calibration, data acquisition and support hardware and appropriate for the DUT(s) being tested.

COMPASS operations follow conventional Windows protocol for file management, menu and message formatting, graphics and editing.

Pressure standards, controllers, piston gauges, temperature controllers and other controlling and measuring devices are set up in **COMPASS** Support Device Definitions (see 4.3, Device Editors). **COMPASS** supports automated operation of most remotely enabled measuring and controlling devices. There is built-in support for all **DHI** products, so a remote command setup is not necessary. Users can create the remote communications profiles necessary to control and read other device. In addition, a database of communications protocols for many controlling and measuring devices is included in **COMPASS**. Visit www.dhinstruments.com for updates to the database. All devices set up in **COMPASS** (DUTs, Support Devices and Piston Gauge Components) can be configured to provide multiple outputs. For example, a DUT can be setup to not only provide DUT pressure, but to also supply temperature, humidity and pressure control. Throughout **COMPASS**, devices are selected by the measurement or control function they accomplish, rather than by the specific device.

Devices to be tested are set up in DUT Definitions and test procedures are set up in Test Definitions. Test Definitions can be associated with DUTs so that when the DUT is selected, the test procedure that goes with it is automatically identified. Tests are executed using the pressure measurement, control and data acquisition devices specified in the Test Definition and/or in the Default Hardware Configuration. Tests execute with the level of automation supported by the available hardware. Test data is acquired and stored in a delimited Data File and may be added directly to a database. Within **COMPASS**, Data Files may be viewed, used to generate plots and used to generate reports that can be customized with user editable templates (see).

Many operational aspects of **COMPASS** are configurable with user options. The use of these configurable preferences results in a customized test environment to meet a very wide variety of testing requirements.

User access to various parts of **COMPASS** can be restricted to prevent confusion or corruption of existing setups (see 24.3, [Database], [Users]). An administrator can create and maintain device definitions that cannot be modified by other users. All device definitions are tagged with the last edit date and the user that saved the edit. This helps to maintain the metrological integrity of **COMPASS**.

Running a test sequence requires:

- A DUT Definition to define the device(s) to be tested.
- Support Device Definitions for all hardware to be used (reference pressure measurement, reference pressure control, data acquisition, auxiliary devices if needed…).
- A Test Definition to define the test procedure. The Test Definition is not required to run a Manual Test.

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3.2 RUN MODES

Run mode refers to **COMPASS**'s automatic test execution functions. The top of the main screen always displays the current run mode. **COMPASS** has three run modes. Typically, devices are polled over their remote interface while in a run mode. All run modes support the ability to log data to a Data File. There are two run modes and an idle mode as follows:

Idle — No run mode is active. Non-run menu items such is **[Setup]**, **[Tools]**, **[Data]** and **[Database]** can only be accessed in this mode. They are not available in active run modes.

Run Test Definition — Activated by the **[Run]**, **[Run Test Definition]** menu option. This run mode is to test DUT(s) using a specific test script in a Test Definition (see 7.2, [Run], [Run Test]).

Run Manual Test — Activated by the **[Run]**, **[Run Manual Test]** menu option. This run mode is to run various devices. There are no constraints as to what devices may or may not be included (see 7.5, [Run], [Run Manual Test]).

3.3 DEVICE (INSTRUMENT) SUPPORT CONCEPT

3.3.1 MEASUREMENT DEVICES

COMPASS for Pressure approaches the support of test devices differently from previous COMPASS applications. To open COMPASS to support third party reference and a wider range of DUT and support devices, a new approach was developed that supports multiple output types from the same device. Even experienced users of previous versions of COMPASS should familiarize themselves with this section to gain an understanding of this powerful new device handling scheme.

Setting up and using devices (devices) is central to the design and operation of **COMPASS**. Most automated testing consists of sending instructions, reading and sometime manipulating data from devices interfaced to the computer that is running **COMPASS**.

In **COMPASS**, individual devices are set up by manufacturer, model and other identifying information. For each device, one or more *final outputs* and/or *final sets* are created. *Final* outputs and *final sets* are the ultimate quantity to be measured or set by a device. The Raw Output to Final Output Relationship Manipulator processes one or more *raw outputs* into a f*inal output* (see 4.3.6.2, Output Relationship Editor). *Raw outputs* may originate from the device itself, or they may be the *final output* of another device. **COMPASS** supports a specific list of r*aw outputs* and *sets* and *final outputs* and *sets*. See **Figure 1** for schematic examples of how device raw outputs and final outputs are set up.

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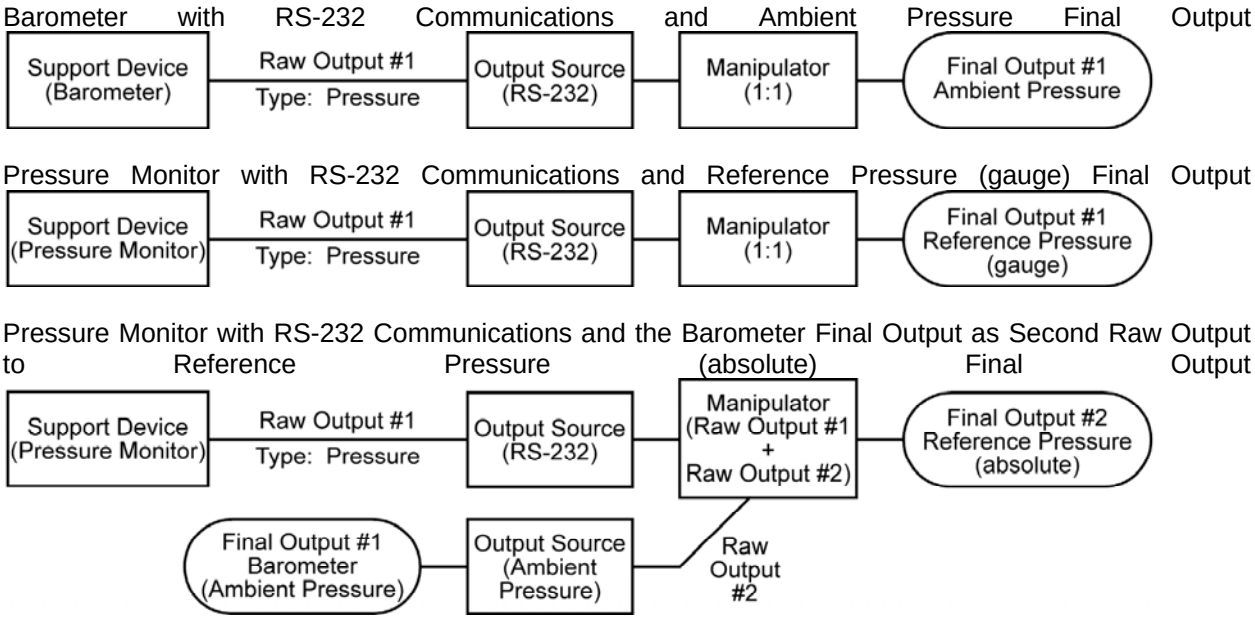
3.3.2 BAROMETER AND MONITOR FOR GAUGE AND ABSOLUTE PRESSURE FINAL OUTPUTS


Barometer with RS-232 Communications and Ambient Pressure Final Output
Support Device (Barometer)
Raw Output #1
Type: Pressure
Output Source (RS-232)
Manipulator (1:1)
Final Output #1 Ambient Pressure
Pressure Monitor with RS-232 Communications and Reference Pressure (gauge) Final Output
Support Device (Pressure Monitor)
Raw Output #1
Type: Pressure
Output Source (RS-232)
Manipulator (1:1)
Final Output #1 Reference Pressure (gauge)
Pressure Monitor with RS-232 Communications and the Barometer Final Output as Second Raw Output to Reference Pressure (absolute) Final Output
Support Device (Pressure Monitor)
Raw Output #1
Type: Pressure
Output Source (RS-232)
Manipulator (Raw Output #1 + Raw Output #2)
Final Output #2 Reference Pressure (absolute)
Final Output #1 Barometer (Ambient Pressure)
Output Source (Ambient Pressure)
Raw Output #2

3.3.3 PRESSURE TRANSDUCER WITH VOLTAGE RAW OUTPUT READ BY DMM AND CONVERTED TO PRESSURE FINAL OUTPUT

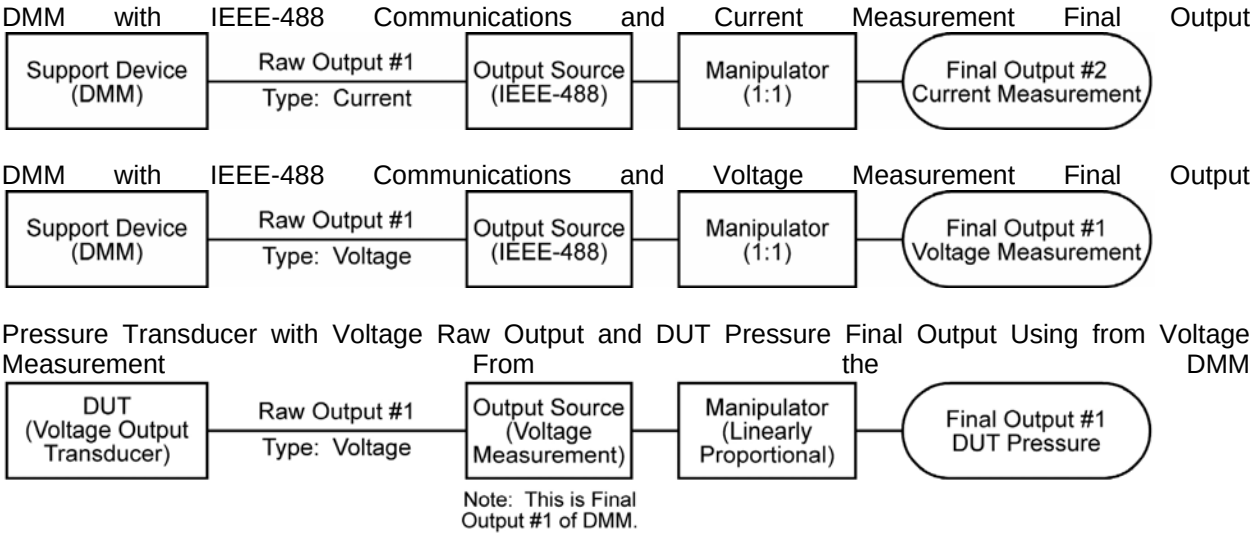

DMM with IEEE-488 Communications and Current Measurement Final Output
Support Device (DMM)
Raw Output #1
Type: Current
Output Source (IEEE-488)
Manipulator (1:1)
Final Output #2 Current Measurement
DMM with IEEE-488 Communications and Voltage Measurement Final Output
Support Device (DMM)
Raw Output #1
Type: Voltage
Output Source (IEEE-488)
Manipulator (1:1)
Final Output #1 Voltage Measurement
Pressure Transducer with Voltage Raw Output and DUT Pressure Final Output Using from Voltage Measurement From the DMM
DUT (Voltage Output Transducer)
Raw Output #1
Type: Voltage
Output Source (Voltage Measurement)
Manipulator (Linearly Proportional)
Final Output #1 DUT Pressure
Note: This is Final Output #1 of DMM.

Figure 1. Device Setup Raw Output and Final Output Examples

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Devices are set up in Devices Definitions. Devices Definitions are divided into three different types. The three types of device definition are:

DUT Definition — Defines devices that will be tested. Must provide a DUT Pressure *final output*. Advanced DUT Definitions can provide multiple DUT outputs as well as other non-DUT outputs.

Support Device Definition — Defines devices used for reference pressure measurement, control and other support devices such data acquisition devices and temperature controllers and data acquisition devices. Support devices are not normally DUTs, though they can be made to act as DUTs by selecting **<This device can be used as a DUT>** in the Support Device Editor.

Piston Gauge Platform Definition — Defines piston gauges and deadweight testers. Does not require a final output. By default, a Piston Gauge provides a reference pressure final output. All situations that require a reference pressure device include all available Piston Gauge Definitions. To use the Piston Gauge as a DUT, use the **<This device can be used as a DUT>** on the Piston Gauge Platform Editor. Use the **<M&TE>** choice on the **<Calibration>** of the Piston Gauge Platform Editor (see 4.3.4, [Calibration] Tab) and an **[Options]**,**[Initialize Test]** choice (see 14.3, [Initialize Test] Tab) to segregate reference and DUT piston gauges.

Device Definitions are created and edited in Device Editors. Each Device Definition Type has its own Device Editor. DUTs are setup in the DUT Editor; Piston Gauges/Deadweight Testers are setup in the Piston Gauge Editor; all other devices are setup in the Support Device Editor. The editors all provide features to view, create and remove final outputs and final sets on the editor's **[Output]** and **[Set]** tabs. Piston-cylinders, mass sets, and mass bells are setup separately from Piston Gauges and Deadweight testers in the Piston Cylinder Editor, Mass Set Editor and Mass Bell Editor, respectively.

The creation of a Test Definition and/or the process of Test Initialization require the selection of devices to perform the reference pressure measurement, control and other functions that may be needed in the test. For selection purposes, devices are sorted and offered by the *final output(s)* they support. For example, when testing a DUT whose output is "Volts", **COMPASS** uses a device that has been set up with "Volts" as its final output. **COMPASS** provides two ways to select devices organized by the *final output* the devices support: a) the Setup Selector; and, b) a drop down list of devices per final output. Which way of selecting devices is used, depends on the current **COMPASS** context. The Setup Selector provides multiple fields of information on each device. This makes it easy to discriminate between different devices providing the same final output. The drop down list of devices displays a more limited set of information identifying the device. Use the **[Options]**, **[Initialize Test]** tab to customize the information displayed in the list (see 14.3, [Initialize Test] Tab). Device selection can be made:

- Automatically by specifying the device in a Test Definition. The Test Definition selection takes precedence over the Default Hardware Configuration;
- Automatically during Test Initialization by specifying the device in the Default Hardware Configuration;
- Manually during Test Initialization by making an alternate selection.

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Devices that have more than one defined final output of a given type are listed more than once when selection of that final output type is being made. For example, a reference pressure controller may have multiple reference pressure final outputs corresponding to multiple ranges. In this case, the pressure controller should be set up with multiple final outputs that should be distinguished one from the other using the final output label. The same controller will appear several times when making a selection of a source to supply the reference pressure final output. Make sure to select the correct final output, the one corresponding to the desired range. The same is true of a pressure controller that can be used in more than one measurement mode (for example, gauge and absolute). It needs a reference pressure final output for each measurement mode. This does not apply to DHI products setup using the <Auto Detect Setup> feature. In this case, COMPASS handles the multiple final outputs automatically without requiring set up of each final output individually.

DHI products created using the **<Auto Detect Setup>** feature of the Device Editor are not handled in the same way as other **COMPASS** device setups (see 4.3.3, [Header] Tab). **COMPASS** automatically includes final outputs provided by the **DHI** device in all appropriate lists. For example, a PPC3 provides: Reference Pressure, Reference Line Pressure, Test Pressure Control, Line Pressure Control, DUT Pressure and Ambient Pressure.

Multi-range products such as the PPC2+ and PPC3 are listed only once when selecting a final output source. **COMPASS** handles the multiple final outputs and allows selection of the desired range when the device is initialized (see 7.3.3.2, Configure DHI Device).

3.3.4 CONTROL DEVICES

Read the Measurement Devices section, before reading this section.

Control features for a device are setup and used on the same principles as measurement devices. The same device may have both *final outputs* (measurements) and *final sets* (controls). This is the case with a reference pressure controller that both sets pressure and serves as the reference pressure measurement.

A device may have one or more *final sets*. *Final sets* are the ultimate quantity to be set by a device. The **Raw Set to Final Set Relationship Manipulator** processes one or more *raw sets* into f*inal sets* (see Set relationship editor). *Raw sets* may originate from the device itself, or they may be the *final set* of another device.

Target pressure and temperature values are controlled by manual prompts to the test operator or by sending remote commands to the controlling device. In the event the controlling device itself is controlled, commands are sent to the raw controlling device. This example is shown in the figure above. A voltage controlled pressure regulator is the pressure controller. However, the voltage supply device must be controlled by **COMPASS** to set a pressure.

3.3.5 OUTPUT CONTROL

Automated control of an output requires **COMPASS** to format the desired target into a remote command and issue it to the remote device. The remote commands are defined in the **Remote Command Editor** accessed in the DUT, Hardware or Piston Gauge Platforms editors. Tools in these editors allow commands to be formatted using the **<Remote Command Editor>** (see 4.4, Remote Command Editor). The **<Remote Command Editor>**

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allows the user to specify how to merge the target with the remote command to control the device. This setup is not required when using **DHI** products for control.

When running tests, devices that support automated control can be adjusted using their run screens or the **Test Conditions Run Screen** (see 5.5.3, TEST Conditions Run Screen). Click the target output display, enter the desired target and press **[Enter]** on the keyboard. When running a **Test Definition** in **[Run Test]** mode, this feature can be disabled by using a **[Tools]**,**[Options]**, **<Run Test>** preference (see 14.4, [Run Test] Tab).

3.3.5.1 REGULATION

When test controllers and references both use a remote interface, regulation is supported by **COMPASS**. Regulation allows control to be to the measurement of a device other than the controller. For example, the controller may regulate to the device outputting reference pressure or to the DUT. This allows the output to be set to DUT cardinal points.

In regulation mode, the test target command is sent to the controller. Then, at a time interval, **COMPASS** corrects the target value sent to the controller to reach the desired target as read by the output reference or DUT device. This process continues until a new test point is set. The correction is calculated using the current desired target, the last attempted target and the current measured output. 98 % of this correction is used for each adjustment to dampen overshooting. The new target value is limited by 10% of the maximum output of the controller and 5% of the target value. The adjustment equation is as follows:

$$T_{New} = T_{Last}\left[1 + 0.98\left(\frac{T_{Set}}{O_{Meas}} - 1\right)\right]$$

VARIABLE	FEATURE
T_{New}	The new target output. This value is formatted into a remote command and issued to the controlling device as long as it does not exceed 110 % of the **<Max Final Output>** and it differs from the last target (T_{Last}).
T_{Last}	The last target output issued.
O_{Meas}	The measured output of the regulation reference device. This can be the output of the DUT or the reference. The choice is made in the **<Test Editor>**.

Zero target outputs are not regulated.

COMPASS will not attempt to set a target that exceeds the maximum controller output by more than 10%. In this case, 110 % of the <Max Final Output> is attempted. Any calculated target that exceeds the output by more than 5% is ignored.

Regulation mode is selected on the **Test Editor**, **[Pressure Tab]**, **[General]** child tab. The regulation readjustment time interval is the **<Regulation Delay>**. Click the Device Output Run Screen of a controller to display a popup menu of options. Regulation can be engaged or disengaged by using this menu.

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3.3.5.2 JOG

Use jog when small adjustments to target output is desired after the target has been set but before data acquisition. The most common use of jog is setting a manual DUT, such as an analog gauge, to its cardinal point before reading back the actual pressure from the reference.

When running the test, use the **[Increase]** and **[Decrease]** arrows to vary the target output by the amount specified next to the jog buttons. A fixed 2s delay occurs after each jog step. This prevents repeated jog steps from piling up in the buffer and causing erratic behavior when using slower remote interfaces.

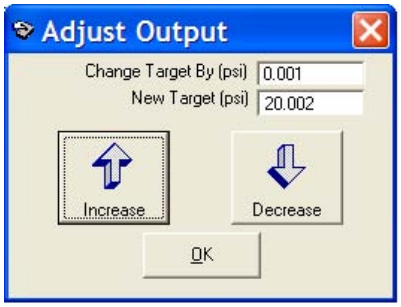

Figure 2. Set Jog

3.3.5.3 READY/NOT READY

COMPASS provides two methods to determine if a controller is *Ready*. This means that the desired target output has been achieved within a predefined criterion and it is acceptable to take test data or to move on with other test steps. The specific method used is selected in a Test Definition (see 8.6.7). Manual Tests require the test operator to decide when it is acceptable to acquire data. Therefore, no specific ready criterion is available. Both methods include a timeout to prevent a test from hanging while waiting for a ready condition. A Ready Hold time is also available to prevent a momentary ready condition from being accepted as a true ready condition.

The first method is to read the *Ready* condition directly from the instrument. This is possible only when the controller uses a remote interface and is setup with the **<Use Ready Commands>** option (see 4.3.7, [Set] Tab). When this method is employed, **COMPASS** will poll the device for the ready state after any target output is set. This method does not apply to multiplexer and valve driver controllers.

If the controller is a **DHI** product, the hold and stability settings defined in the Test Definition are set to the device after the Test Initialization is complete if the **<Use Ready Commands>** option is selected (see 7.3, Test Initialization). A zero hold or stability value in Test Definition prevents **COMPASS** from changing the hold or stability criterion in the controller. In this case, the controller's default limits are used automatically. In many cases, the default control limits are the most appropriate for testing.

The second *Ready* determination method requires a reference instrument that uses a remote interface. When available and the **<Use Read Commands>** option is not selected in a Test Definition, **COMPASS** will apply the hold and stability limits to the reference output to determine a ready condition. This means that the reference output is within the hold limit relative to the target output and stable within the stability limit. Using a hold or stability setting of zero effectively turns off the criterion.

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3.3.5.4 PISTON GAUGE READY/NOT READY

In most cases, the ready condition of a piston gauge is defined by the test operator. **COMPASS** displays the masses to load to set the required target pressure and prompts the user to respond when the piston is floating and stable. This is the case whenever the test pressure controller selection is set to **<Manual Control>**.

When the pressure reference is a piston gauge and the corresponding test pressure controller is not set to manual, **COMPASS** assumes that the controller will load the required test mass and float the piston. Whether or not the controller performs both tasks is not important. It is important to realize that **COMPASS** will wait for a *Ready* condition before continuing with the next test step. In some cases the controller may simply load the required mass and the user will float the piston. The specific operations of the controller are specific to the current piston gauge setup and user preference.

After the target pressure is set in an automated piston gauge controller, **COMPASS** will wait for a *Ready* condition. There are two ways of determining *Ready*: 1) The controller outputs a *Ready* response by using Ready Commands; 2) The measured piston position is within the test defined Dead Band. Regardless of the ready case used, the reference *Ready* indicator on the **DUT/Reference Comparison** run screen is based on case 2. If case 2 is not available, there is no reference ready indicator. In both cases a Ready Hold time is also available in a Test Definition to prevent a momentary ready condition from being accepted as a true ready condition.

Case 1 is possible only when the controller has the **<Use Ready Commands>** option selected and the Test Definition specifies the use of the controller's Ready Commands (see 8.6.7). This case is unavailable when running Manual Tests.

Case 2 is possible only when an instrument with a remote interface is used to provide the piston position. The piston position measuring instrument must be selected with the piston gauge during test initialization (see **Configure Piston Gauge/DeadWeight Tester**, 7.3.3.3). The piston gauge is assumed to be *Ready* when the absolute piston position is less than the absolute value of the Dead Band piston position defined in a Test Definition. When running a Manual Test, the Dead Band value specified in **[Tools]**,**[Options]**,**[Piston Gauge]** is used.

When a remote device is used to measure the piston position and an instrument with a remote interface is selected to output the piston rotation rate, the instantaneous piston rotation rate is compared to the min/max rotation limits defined in the selected piston-cylinder (see **Piston gauge type piston-cylinder**, 11.3.4.1). If both the piston position and the rotation rate are within the defined limits, the piston gauge is *Ready*, otherwise it is assumed to be *Not Ready*.

3.4 USING A MULTIPLEXER

Multiplexers are used in **COMPASS** to support multiple devices by switching signals to a single measuring device. For example a multiplexer can be used to read 5 DUTs with a single DMM. **COMPASS** triggers the measurement of each device with a specific multiplexer channel selected during Test Initialization (see 7.3.3, Configure DUT(s)/Devices). A device output or remote command setup must enable the use of a multiplexer to enable channel selection during Test Initialization (see 4.3.6.2.2, [Final Output] Tab Setup procedure).

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To use a multiplexer to read the output of multiple DUTs with a single DMM or other support device do the following:

1. Create the DUT with the proper raw output source for the raw output type ("Voltage Measurement", "Frequency Measurement", ect).

2. Create a support device to read the output of the DUT. This is the device that will read the DUT after the multiplexer selects the proper channel. This may be the same support device that is used for multiplexing.

3. Create the multiplexer support device to switch channels based on the current configuration. This requires an output to be created on the **[Set]** tab of the **Device Editor**. Select **<Mux Channel>** as the **<Set Type>** on the **Set Relationship Editor**. Define remote commands for the multiplexer depending on how it will be used (see 3.4.1 and 3.4.2).

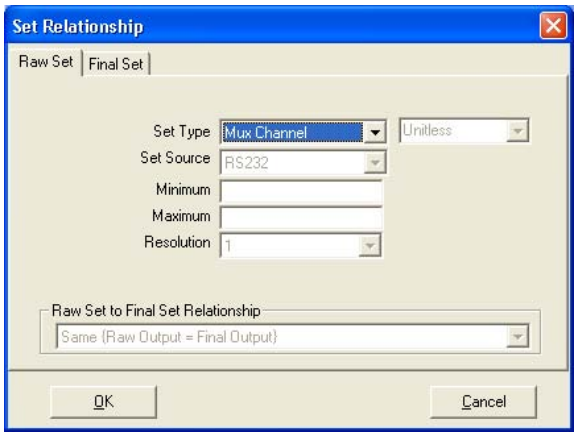

Figure 3. Multiplexer Set Relationship

4. Run a test and select the DUT. When configuring the DUT, select the device defined in step 2 as the raw output source. Check the **<Use Multiplexer>** option and enter the multiplexer channel that corresponds to the DUT.

5. Continue with the Test Initialization. On the **Test Hardware Configuration** step, select the multiplexer defined in step 3.

6. Complete the initialization process with any other test specific settings. **COMPASS** will set the multiplexer to the channel defined for the first DUT then read the output of the raw output source device(s) to update the DUT value. The channel for the second DUT is then set and again the raw source device(s) is queried to obtain output information. This process continues until all DUTs have been read, then it resumes again with the first DUT.

From a **COMPASS** perspective, all multiplexer channels are always integer values beginning with 0. The actual channel setup depends on the electrical connections specific to the device setup. It is up to the user to associate the integer based channels (0 – n) with the electrical connections of the multiplexer. The remote commands of the multiplexer must handle any channel specific operations associated with the test setup (see 4.4.3.2, Multiplexer/Valve Driver Commands).

There are 2 classes of multiplexer setups: Switching multiplexers that are used for switching only and the combination multiplexers that are used for switching and measuring. Other than the specifics of setting up the multiplexer, the selection process of both setups is the same. See **Figure 4** and refer to the following sections for details on these setups.

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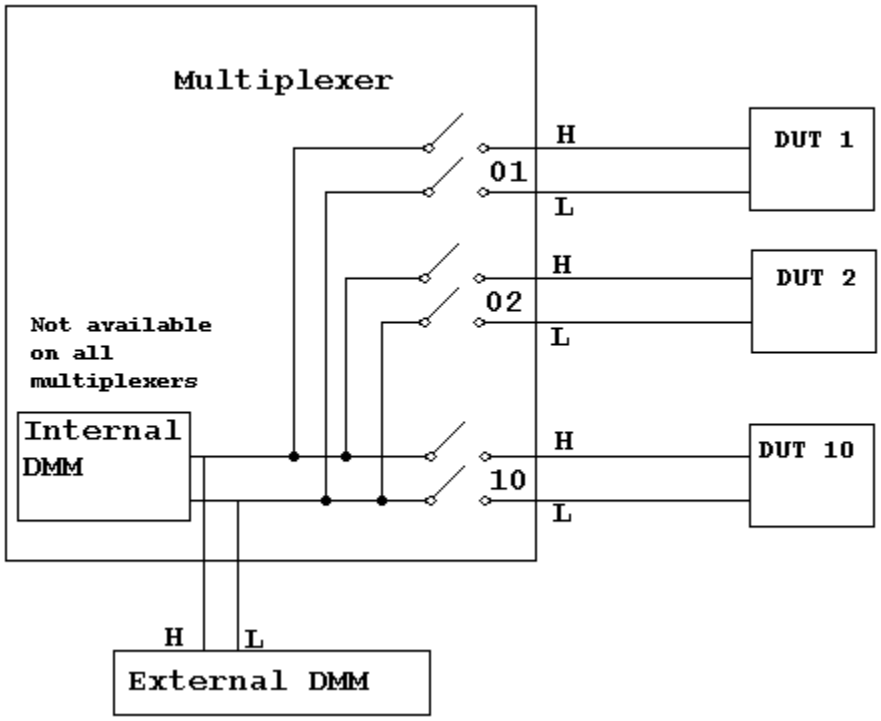

Figure 4. Typical Multiplexer Connection

3.4.1 SWITCHING MULTIPLEXER

A switching multiplexer is available for switching channels only. When this type of multiplexer is used, an external DMM is required to measure the actual output of a device. This multiplexer configuration is commonly used even when the multiplexer has a built in DMM. To use voltage output DUTs with this setup, define the DUT to use Voltage Measurement as the raw output source. Create a support device DMM and a support device multiplexer. During test initialization, when the DUT is selected, an option to select the DMM and specify the multiplexer channel is available (see 7.3.3, Configure DUT(s)/Devices).

As with any setup, a multiplexer setup will not work properly unless the remote commands defined in the multiplexer setup select the proper channel. Many multiplexers support the basic SCPI commands to close a channel exclusively: "ROUTE:CLOSE:EXCLUSIVE". The text following this command may differ for different multiplexers and configurations. Refer to the multiplexer documentation for details. Several common multiplexer commands are listed in **Table 2**.

Although the commands defined in this section are common, they are not guaranteed to work for all multiplexers. Special commands may be required to put the device in remote mode prior to sending the other commands. It is important to refer to the product specific documentation for details on using the remote interface of any remote device used by COMPASS.

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Table 2. Common Multiplexer Channel Commands

COMMAND	ACTION
ROUTE:CLOSE:EXCLUSIVE (@101)	Turn on channel 1 only.
ROUTE:CLOSE:EXCLUSIVE (@101, 102)	Turn on channels 1 and 2 simultaneously.
ROUTE:CLOSE:EXCLUSIVE (@105, 205)	Turn on channel 5 on multiplexer channel banks 1 and 2. This is possible only when the multiplexer supports more than one internal channel bank.
CLOSE 101, 102	Turn on channels 1 and 2 simultaneously. The other channels are left in their current state. A channel reset command should be used prior to closing commands in this way.
OPEN 101, 102	Turn off channels 1 and 2 simultaneously. The other channels are left in their current state.

The commands defined **Table 2** are all easily implemented by using the <Replace [x]> option in the **Remote Command Editor** (see 4.4.3**)**. The text "[x]" is substituted for the channel number (see **Figure 5**). When the channel is set to 3, the "[x]" becomes "3" and the remote command is "ROUTE:CLOSE:EXCLUSIVE (@103)". The only limitation is that the required multiplexer channel must not exceed 9. If channel 11 is used, "[x]" becomes "11" and the remote command is "ROUTE:CLOSE:EXCLUSIVE (@1011"). In most cases this is incorrect. If the device supports 11 channels the format is typically "ROUTE:CLOSE:EXCLUSIVE (@111)". To handle this case and other extended channel function, a **Get Command Macro** is required (see 18.5.2). Select and edit these macros by using the drop down menu choice in the **<Command>** field. **Table 3** defines macros to use to handle extended multiplexer channels.

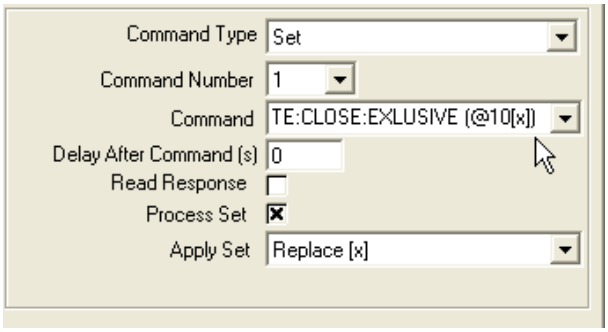

Figure 5. Common Multiplexer Command Setup

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Table 3. Switching Multiplexer **Get Command Macros**

MACRO CODE FOR AN AGILENT 34970A DAQ/SWITCH UNIT

```
'****************************************
'This Function must return the command to be sent to a remote
'Multiplexer that uses the SCPI protocol.  Only 1 channel bank
'is supported by this macro.
'
'Target    :Target value when the SetMode it True.
'ChnlSt    :True/False to activate or de-active a valve driver.
'SetMode   :True for Set commands, False for all other commands.
'ParamID   :Parameter ID of the device
'cDevice   :Device class that the relation ship applies to.
'
'The value is returned by setting the function name =
'to the calculated value..
'
'****************************************
Function SetMultiplexerChannel(Target, ChnlSt, SetMode, ParamID, cDevice)

if Target > 9 then
    cmd = "1" & target & ")"
else
    cmd = "10" & target & ")”
end if

cmd = "ROUTE:CLOSE:EXCLUSIVE (@" & cmd

SetMultiplexerChannel = cmd

End Function
```

```
'****************************************
'This Function must return the command to be sent to a remote
'Multiplexer that uses the SCPI protocol.  Up to 3 channel
'banks are supported by this macro.  It is assumed that each
'channel bank has 20 individually switchable channels.  This makes
'the channel total 60.
'
'Target    :Target value when the SetMode it True.
'ChnlSt    :True/False to activate or de-active a valve driver.
'SetMode   :True for Set commands, False for all other commands.
'ParamID   :Parameter ID of the device
'cDevice   :Device class that the relation ship applies to.
'
'The value is returned by setting the function name =
'to the calculated value..
'
'****************************************
Function SetMultiplexerChannelEXT(Target, ChnlSt, SetMode, ParamID, cDevice)


if Target >= 1 and Target < 21 then
    'BANK 1 chnl 1- 20
    tBase =  Target
    BANK = "1"

elseif Target >=21 and Target < 41 then
    'BANK2 channel 1 - 20
    tBase =  Target -20
    BANK = "2"

elseif Target >=41 and Target < 61 then
    'BANK3 channel 1 - 20
    tBase =  Target - 40
    BANK = "3"

else
    'This is some type of an error
    exit function
end if


'Must be a 3 digit value 101, not 11
if tbase < 10 then
    cmd =  BANK & "0" & tBase
else
    cmd =  BANK & tBase
end if

SetMultiplexerChannelEXT = "ROUTE:CLOSE:EXCLUSIVE” & cmd

End Function
```

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3.4.2 MULTIPLEXERS WITH INTERNAL DMMS

Multiplexers with internal DMMs can be used to change channels and read the output of a DUT. In most cases, these multiplexers are setup with multiple outputs to read the supported electrical signals (voltage, current, ohms, frequency ect.) and a controlling output to change multiplexer channels. The selection and use of the individual outputs and the channel switching are no different than in the case of any other device in **COMPASS**. There are 3 common methods of setting up the remote commands to change channels and read the output: Direct Output, Switched Output and Scanned Output. The pros and cons of these methods are summarized in **Table 4**.

Table 4. Pros and Cons of Multiplexer Setups with Internal DMMs

METHOD	PRO	CON
Direct Output	Easiest method to use to get started when 5 or fewer channels will be used. This setup works independently of a multiplexer so a multiplexer channel definition is not required.	A unique output definition is required for each specific electrical output and channel used. Should not be used when more than 5 channels are used at a time. A channel specific output must be selected for each device that uses the multiplexer.
Switched Output	Supports multiple channels with only 1 output and set definition per electrical output used. Easy to setup during a test initialization.	Each defined output only works with the corresponding multiplexer set. Data acquisition degrades when more than 10 channels are used.
Scanned Output	Fastest data acquisition when many channels are used. Only 1 multiplexer Set definition is required for all electrical outputs. Easy to setup during a test initialization.	Most difficult setup of the three. Remote commands must be created by using **COMPASS Macros**.

Although the commands defined in this section are common, they are not guaranteed to work for all multiplexers. Special commands may be required to put the device in remote mode prior to sending the other commands. It is important to refer to the product specific documentation for details on using the remote interface of any remote device used by COMPASS.

3.4.2.1 DIRECT OUTPUT

The direct output method of reading electrical output values from a multiplexer is very similar to setting up any other DMM. The key difference is that each supported output should use a remote command to set a specific channel and return the output value opposed to simply returning the output value. This setup does not require the definition of a multiplexer Set since each read output automatically changes multiplexer channels.

To use a multiplexer with an internal DMM to read 4 voltage output DUTs, the multiplexer should be defined to have 4 voltage outputs by using the **Support Device Editor** (see 4.3.6). Distinguish each output by a specific final output label (see **Figure 6**). When initializing DUTs during test initialization, select the multiplexer output that corresponds to the multiplexer channel used by the DUT (see **Figure 7**). To simplify output selection, use the **[Tools]**, **[Options]**, **[Initialize Test]** feature to list outputs by their final output label.

Use the direct output method to quickly get started when only a few channels are required. When multiple channels are necessary, the selection process becomes very cumbersome because each channel and output type requires a unit output definition. If this is the case use one of the switched output or the scanned output method.

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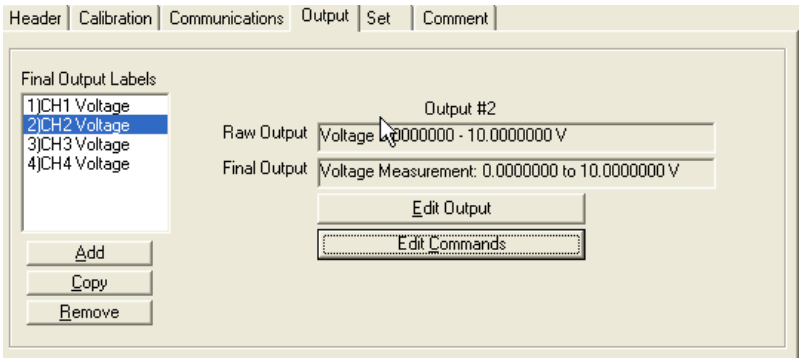

Figure 6. Multiplexer Individual Output Setup

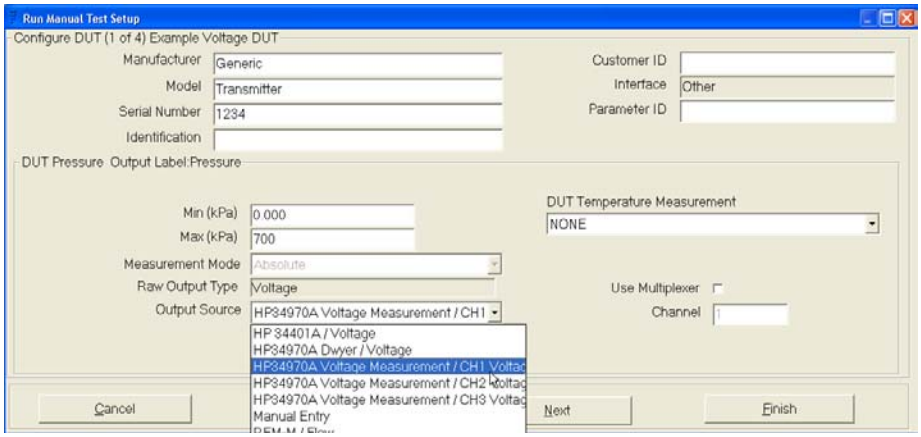

Figure 7. Multiplexer Channel Specific Output Source Selection

3.4.2.2 SWITCHED OUTPUT

Switched outputs use a multiplexer Set output to change to a specific channel and a Read output to obtain the specific electrical signal. This setup is similar to the Switching Multiplexer setup described in section 3.4.1. The key difference is that one device is used to change channels and read the electrical output.

Create a multiplexer set by using the **[Set]** tab of the **Support Device Editor**. Setup the multiplexer output commands to switch channels and acquire a measurement. This configures the internal DMM to read the desired electrical output on the current channel. The output value returned by this command (when applicable) is not used by **COMPASS**. The individual read outputs are used to read the active measurement configured by the set command. **Table 5** lists several Set and Read remote commands.

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Table 5. Common Multiplexer Channel and Measurement Commands

SET COMMAND	READ COMMAND	ACTION
MEAS:VOLT:DC? (@101)	**READ?**	Switch to channel 1 and return the DC voltage measurement. The value is returned by both the set and read commands.
MEAS:CURRENT:DC? (@205)	**READ?**	Switch to channel 5 on the second channel bank in the multiplexer and return the DC current measurement. The value is returned by both the set and read commands.
MEAS:Resistance? (@113)	**READ?**	Switch to channel 13 and return the resistance measurement. The value is returned by both the set and read commands.

Create the multiplexer set commands by using the **<Replace [x]>** option when less than 10 channels will be used or use one of the macro options when 10 or more channels will be used (see 3.4.1).

Using this setup method requires a unique multiplexer Set for each Read output type used. The Read outputs cannot be used without the corresponding multiplexer Set. A DUT that uses the voltage output from this multiplexer as a raw output must use the voltage multiplexer channel output. To simplify the output selection process, define unique labels for each output and set.

3.4.2.3 SCANNED OUTPUTS

Scanned multiplexer outputs use macros to define a scan list command for all DUTs that use an electrical output supplied by the multiplexer. The scan list command is used by a multiplexer channel set definition. The outputs are read by defining an output for the multiplexer device to read the electrical output and parse the scan list command response. The reply parsing macro not only parses the outputs, but it also updates the output information of all devices that are setup to use the multiplexer.

Scanned multiplexer device definitions are created following the same principles as other multiplexer device definition. Start by creating a support device and defining an output for each electrical measurement that will be used by **COMPASS**. All output settings and the remote command setups are no different than any other DMM setup. The raw and final output relationship should be **<Same>** and the remote command to read the output of the device must be defined. However, a macro is required to delimit the response (see **Figure 8**). The macro code reads the response to the scan list and passes data to the devices that use the multiplexer (see **Table 6**). Information from various **COMPASS** objects is required for the creation of this macro (see 28, COMPASS Objects and 18.5.6, Reply Parser Macros). The macro should not return a value since all outputs are already updated. Therefore the **[Tools]**,**[Options]**,**[Run Test]** feature should be used to disable the **<Wait for update from each remote device while averaging>** option.

The multiplexer Set definition must be setup to use a macro to create a scan list based on the output type of the DUTs and the multiplexer channel used by each of the DUTs. Most instruments only require the scan list command 1 time so it should be defined as an initialization command. Since the remote command requires knowledge of the current DUT setup, a **Get Command Macro** is used to crate the scan list command (see **Table 6**). Each read request from an output automatically activates the scan list. A command definition is required for the actual Set command even though the scan list command is already defined. **COMPASS** requires that a Set Command exist. Send any command to the device that will not change the state of the device and allows a quick return. A device identification query is a convenient choice. **Figure 9** displays a common Set Command definition used by scanned output multiplexer setups.

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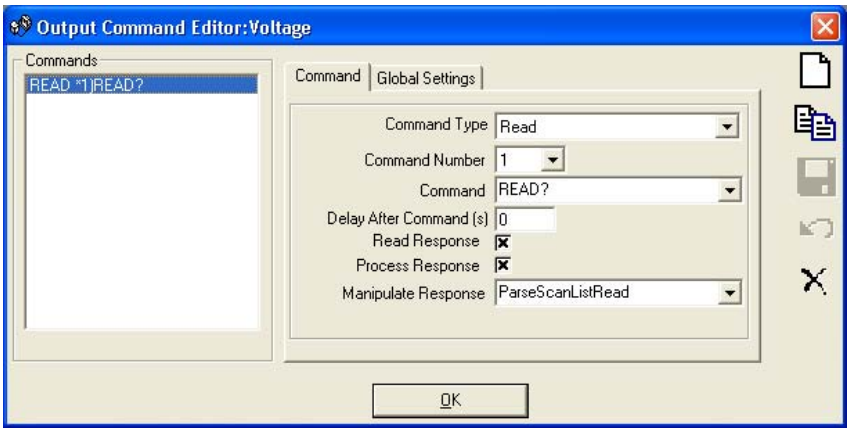

Figure 8. Multiplexer Scanned Output Command Setup

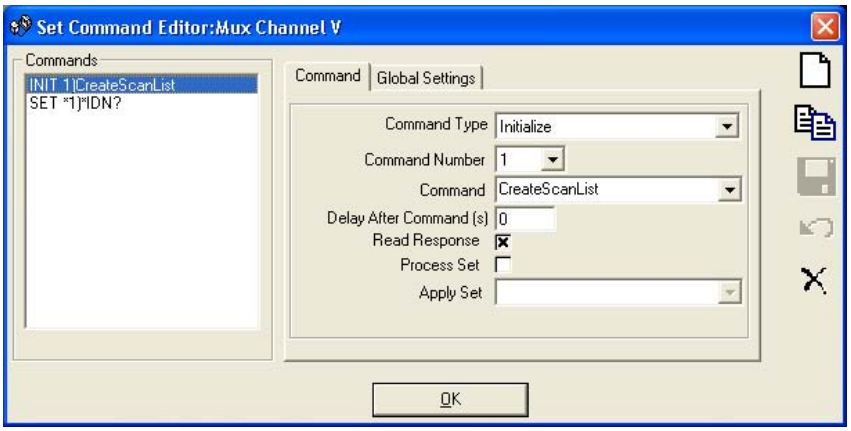

Figure 9. Multiplexer Scanned Set Command Setup

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Table 6. Multiplexer Scanned Output Macros

MACRO CODE TO PARSE A SCANLIST FOR AN AGILENT 34970A

```
'**************************************
'This process the scan list response and passes the data
'to the DUTs that use the response.
'
'Reply     :Raw unmanipulated response of a device.
'ParamID   :Parameter ID of the device
'cRange    :Device Range class that the output applies to.
'
'**************************************
Function ParseScanListRead(Reply, ParamID, cRange)
'When a 34970A is used to scan multiple channels
'at the same time, it responds with all data collected
'from a simple Read? command.  Look at the CreateScanList
'GetCommand MACRO.
'With this setup, parse the responses into the various
'raw outputs of the devices but DO NOT RETURN
'a value for the function.  The Raw Output Update
'will update the output of each device automatically.
‘****This code assumes that the channels
‘****are defined in order

inc = -1  ‘Store response position
With cCOMPASS.cConfig  ‘Use global COMPASS.Configuration object
    for i = 1 to .DUTPrs.Count
        chnl = .dutPrs(i).RangeMain.MuxChannel
        if chnl > 0 and chnl <=60 then
          'The device is setup to use a MUX,
          'So get it's Raw Output
          inc = inc + 1  'Step to the next position in the response
          temp = qextract(reply,inc, inc+1,",")  'Get a value by using a Global Macro
          .dutPrs(i).RangeMain.RawOutput = GetVal(temp) ‘Update the output of the DUT
        end if
    next
End With

'Never Respond,  We already updated the data for all of the DUTs
ParseScanListRead = ""

End Function
```


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MACRO CODE TO CREATE A SCANLIST FOR AN AGILENT 34970A

```
'****************************************
'Create a scanlist for the DUTs  based on their channel
'position and output type.
‘This code assumes
‘     *That all DUTS are using the same output type
‘     *DUTs are defined in ascending multiplexer channel order (1,4,10, 20,ect)
'     *The Raw outputs of the DUTs is V,A,Ohms or HZ
‘
'Target    :Target value when the SetMode it True (Valve Driver Chnl).
'ChnlSt    :True/False to activate or de-active a valve driver.
'SetMode   :True for Set commands, False for all other commands.
'ParamID   :Parameter ID of the device
'cDevice   :Device class that the relation ship applies to.
'
'****************************************
Function CreateScanList(Target, ChnlSt, SetMode, ParamID, cDevice)
'Determine which DUTs are using a multiplexer channel
With cCOMPASS.cConfig
    for i = 1 to .DUTPrs.Count
        chnl = .DUTPrs(i).RangeMain.MuxChannel

        if chnl > 0 and chnl <=60 then
           'The DUT is setup to use a MUX
            if cmd = "" then
                 ‘Store the output type of the DUT, ALL DUTs on the
                 ‘multiplexer must have the same output
                outputType = .DUTPrs(i).RangeMain.TypeRaw
                cmd = GetCahnnelID(chnl)  ‘Get the channel
            else
                cmd = cmd & "," & GetCahnnelID(chnl)
            end if
        end if
    next
End With
'If there is Scan List INFO, then make it happen
if cmd = "" then
    'There is no scan list in this case.  Flash a status bar message
    cCOMPASS.StatusDisplay “There are no DUTs that use a multiplexer”
    exit function
end if
‘Determine what output to read, The Range Class
‘typeFinal definition lists these constants
select case outputType
    case 2 ‘Voltage
        CreateScanList = "MEAS:VOLT:DC? (@" & cmd & ")"
    case 1  ‘current
        CreateScanList = "MEAS:CURRENT:DC? (@" & cmd & ")"
    case 8  ‘Frequency
        CreateScanList = "MEAS:FREQ? (@" & cmd & ")"
    case 9  ‘Resistance
        CreateScanList = "MEAS:RESISTANCE? (@" & cmd & ")"
```

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MACRO CODE TO CREATE A SCANLIST FOR AN AGILENT 34970A

```
    case else
       'The output type is not supported
        cCOMPASS.StatusDisplay “There are no DUTs that use a multiplexer”
        exit function
end select
End Function
'*****************************************
'Return the fully qualified channel
'ID assument that channels are in order
'from 1 to 60 corresponding to
'This function can and should be defined within the same Get Command macro
'
'1-20    BANK 1 channels 1-20
'21-40   BANK 2 channels 1-20
'41-60   BANK 3 channels 1-20
'
'*****************************************
Function GetCahnnelID(chnl)

if chnl>= 1 and chnl< 21 then
    'BANK 1 chnl 1- 20
    tBase =  chnl
    BANK = "1"

elseif chnl>=21 and chnl< 41 then
    'BANK2 channel 1 - 20
    tBase =  chnl-20
    BANK = "2"

elseif chnl>=41 and chnl< 61 then
    'BANK3
    tBase =  chnl - 40
    BANK = "3"

else
    'This is some type of an error
    exit function
end if

'Must be a 3 digit value 101, not 11
if tbase < 10 then
    GetCahnnelID=  BANK & "0" & tBase
else
    GetCahnnelID=  BANK & tBase
end if

End Function
```


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NOTES

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4. COMMON TOOLS AND FEATURES

4.1 SETUP SELECTOR

The Setup Selector is used throughout **COMPASS** to select Test Definitions, DUTs, Support Devices and Piston Gauge Platforms and elements. The Editor Toolbar on all **COMPASS** editors provides a link to the **<Setup Selector>**. This allows a setup to be identified quickly from a list rather than by scrolling through all individual setups.

In the Setup Selector, all setups are listed alphabetically by **<Record Label>**. The selector columns include information that should allow easy identification of a specific setup. Click the desired selection and press **[OK]** or double click the field to make a selection.

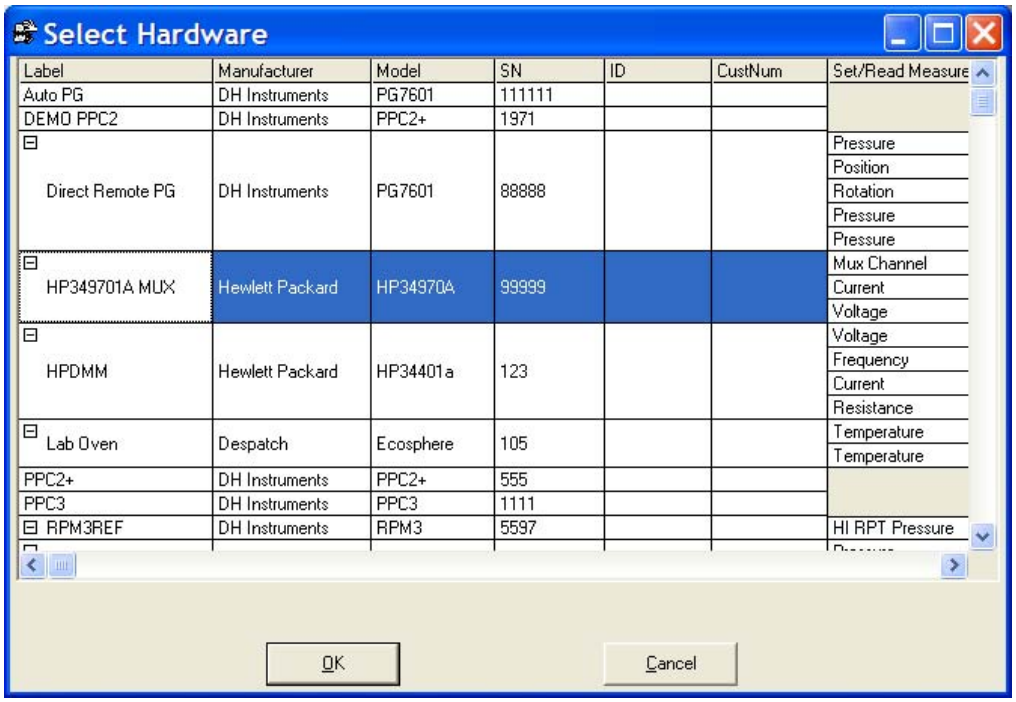

Figure 10. Setup Selector

4.2 EDITOR TOOLBAR

All editors in **COMPASS** use the Editor Toolbar. This includes the DUT, Support Device, Piston Gauge Platform, Piston-Cylinder, Mass Set, Mass Bell and Pressure Media Editors. In the editor, all features not on the tables are considered part of the **Editor Toolbar**. The toolbar identifies the definition that is active in the editor, provides tools to create, delete, save, restore and select a definition to edit.

Use the scrollbar or the **[Select from List]** toolbar icon to pick a setup to edit. A label flashes “Editing” when any changes to an existing setup are made or a new setup is created. Use the **[Restore]** toolbar icon to undo undesired changes.

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Changing the <Record Label> does not create a new instance of a device setup. The [New] or [Copy] toolbar functions must be used to create a new device setup.

Figure 11. Editor Toolbar

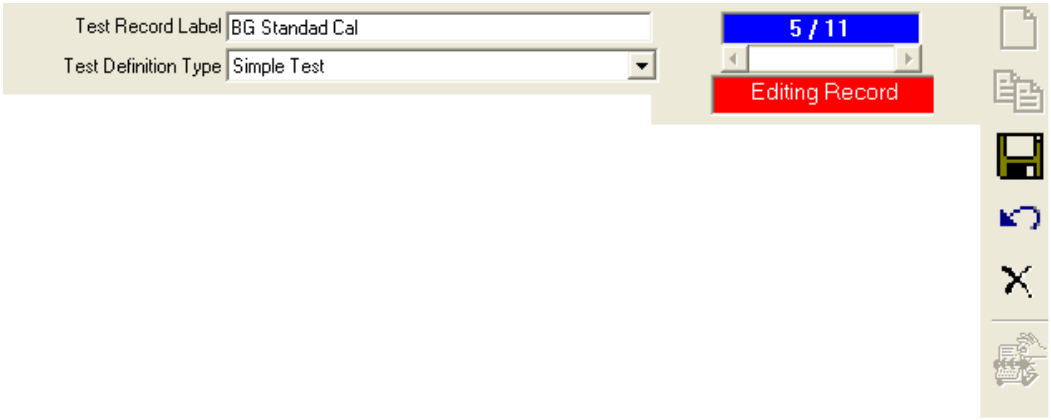

Figure 12. Test Definition Editor Toolbar

Table 7. Editor Toolbar Features

FEATURE	DESCRIPTION
Record label (required text entry field)	This field identifies a unique setup. It is analogous to a file name. The text entered should make the setup easily distinguishable from other setups of the same type. Up to 40 characters can be entered. During Test Initialization, devices are selected and displayed using their **<Record Label>**. Use a **[Tools]**, **[Options]**, **[Initialize Test]** preference to list devices by the **<Record Label>** (see 14.3, [Initialize Test] Tab). *Do not use the following characters in this field: \,/, :, *, ?, ", <,>, |, a comma or tab character. These characters will cause problems when importing the Data File or creating the Data File directory based on the data directory naming convention selected using the [Tools], [Options], [Data File] tab.*

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FEATURE	DESCRIPTION
Test Definition Type (required drop down list selection for Test Definitions only)	Defines the type of Test Definition. **Simple Test** — Basic test that defines a list of pressure points only. No macros or reference changes are permitted. **Simple Test w/Temperature** — Pressure and Temperature points can be defined. No macros or reference changes are permitted. **Simple Test w/Temperature and Line Pressure** — Pressure, Temperature and Line Pressure points are definable. No macro or reference changes are permitted. **Advanced Test** — All test point types are definable. In addition **Test Macros** and reference changes can be used when running a test. COMPASS for Pressure Basic does not support advanced tests.
Editing Record (label)	The red label flashes when changes to a setup have been made but not saved.
New (toolbar icon)	Creates a new setup with default information.
Save (toolbar icon)	Saves changes to an edited setup. This icon is not active when no edits have been made. If the setup is valid it is saved without further prompting. Setups that are incomplete or contain errors generate error messages. Resolve any errors before saving.
Copy (toolbar icon)	Copies the contents of the current setup to a new setup. The **<Record Label>** of the new setup is the copied setup label plus the text **<Copy>**. This is the only difference between the original setup and the copy. Make sure the new setup is properly edited before saving.
Restore (toolbar icon)	Restores a setup that is being edited to the last saved state. Use this feature to abandon edits made before saving. If a new setup was created using the **[New]** icon, the restore button is nonfunctional as the is no previous saved state to restore to.
Delete (toolbar icon)	Deletes the setup that is active in the editor. A message prompt for confirmation displays prior to removing the setup.
Open/Select (toolbar icon)	Select a specific setup using the **[Setup Selector]** (see 4.1, Setup Selector). This is a more efficient way to select a specific setup than scrolling through existing setups.
Scroll Select (scroll bar)	Scrolls to the next setup in ascending alphabetical order by **<Record Label>**.

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4.3 DEVICE EDITORS

4.3.1 OVERVIEW

Device Definitions identify and define the devices that **COMPASS** uses to measure, control and acquire data. Device Definitions are created edited and deleted using **Device Editors.**

See Section 3.3, Device (instrument) Support Concept and become familiar with the support concepts before using Device Editors.

4.3.2 CREATING AND EDITING DEVICE DEFINITIONS WITH DEVICE EDITORS

Device Definitions are divided into three main types. Each type has its own **Device Editor**.

- DUTs are set up in the **DUT Editor** (see 9, [Setup], [DUT]).
- Support Devices are set up in the **Support Device Editor** (see 10, [Setup], [Support Device]).
- Piston Gauge/Deadweight Testers Platforms, Piston-Cylinders, Mass Sets and Mass Bells are set up in various **Piston Gauge Editors**; all other devices are set up in the **Support Device Editor** (see 11, [Setup], [Piston Gauge]).

All of the **Device Editors** have common features that are described in sections 4.3.3,([Header] Tab) to 4.3.8([Comment] Tab).

The **Editors** provide features to view, create and remove final outputs and final sets on the editor's **[Output]** and **[Set]** tabs. All final outputs and final sets are edited using the **Output Relationship Editor**.

4.3.3 [HEADER] TAB

The **[Header]** tab is common to all device and piston gauge metrological element setups in **COMPASS**. This includes DUT, Support Device, Piston Gauge Platform, Piston-Cylinder, Mass Set and Mass Bell Editors. The information on this tab should be used to easily identify a **COMPASS** setup.

Selections made on the **[Header]** tab can change the options on the remaining tabs of an Editor. For example, selecting **<Simple DUT>** as the **<DUT Type>** on the DUT Editor prevents the DUT from acting as a controller. The DUT Editor, **[Set]** tab is displayed or hidden based on this selection. Not all features of the **[Header]** tab are available on all **COMPASS** editors. Table 3 describes the **[Header]** tab features. The Feature column points out where features are not available.

*Do not use the following characters in any of the [Header] fields: \,/, :, *, ?, ", <,>, |, a comma or tab character. These characters will cause problems when importing the Data File or creating the Data File directory based on the data directory naming convention (see 14.8, [Data File] Tab).*

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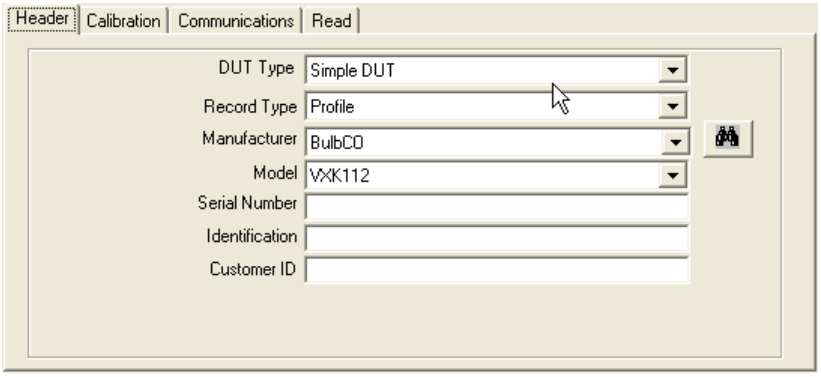

Figure 13. DUT Editor, **[Header]** Tab

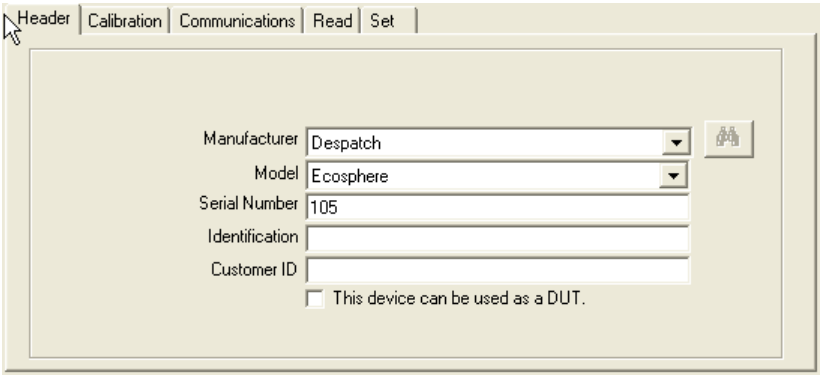

Figure 14. Support Device Editor, **[Header]** Tab

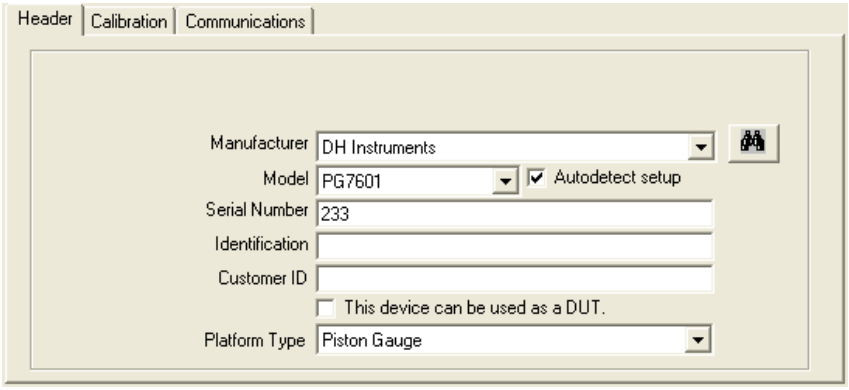

Figure 15. Piston Gauge Platform Editor, **[Header]** Tab

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Table 8. Device Editor, **[Header]** Tab Fields

FEATURE	DESCRIPTION
DUT Type (required drop down list selection; DUT Editor only)	Determines the options available for a DUT Definition. There are two choices: **Simple DUT** — DUTs that have a pressure output only. The DUT cannot control pressure and multiple and/or non-pressure DUT outputs are not supported. **Advanced DUT** — Supports non-pressure and multiple DUT outputs. The DUT may control pressure. Advanced DUTs can be setup to be indistinguishable from other support devices. The characteristic that makes a device a DUT is the selection of **<DUT Pressure>** or **<General Pressure>** as the Final Output. COMPASS for Pressure Basic does not support advanced DUTs.
Record Type (required drop down list selection; DUT Editor only)	There are three DUT Definition Record Types: **Individual** — Intended for DUTs that are tested as specific, unique items. The DUT serial number, identification or customer ID is included in the DUT definition. This type of DUT does not require new entries during Test Initialization. **Profile** — Intended to define a general DUT type rather than identifying a specific DUT. A common use of this option is for a type of analog pressure gauge. Unique serial number, identification and customer ID values are not entered in the DUT Definition. Although range information must be specified, the **<Min Final Output>** and **<Max Final Output>** values can be altered during test initialization. This type of DUT Definition requires the DUT to be identified during Test Initialization. **Profile w/Range** — Intended to define a general DUT type, including a specific range, rather than identifying a specific DUT. It is useful when identical DUTs are tested in groups. Instead of creating multiple DUTs all differing only by serial number and/or identification, use a DUT profile w/Range. Unique serial number, identification and customer ID values are not entered in the DUT Definition. This type of DUT Definition requires that the DUT be identified during Test Initialization. Range related information cannot be edited during Test Initialization.
Manufacturer (required drop down list selection)	Select a manufacturer from the drop down list box or enter a new manufacturer into the field. Selecting a manufacturer from the list automatically updates a list of corresponding <Models>. Devices (DUT, Support Devices and Piston Gauge Platforms) included on the list have existing or example setups in the COMPASS database. Use the [Find Previous Setup] button to copy an existing setup. The default Data File directory naming preference can use DUT **<Manufacturer>** as part of the Data File directory structure.
Model (required drop down list selection)	Select the **<Model>** from the drop down list or enter a **<Model>** into the field. The drop down list of **<Models>** is based on the currently selected **<Manufacturer>**. Models selected from the list have existing or example setups in the COMPASS database. Use the [Find Previous Setup] icon to copy an existing setup. The default Data File directory naming preference can use DUT **<Model>** as part of the Data File directory structure.

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FEATURE	DESCRIPTION
Find Previous Setup (conditional icon on available in device editors only)	Press this option to search the **COMPASS** database for an existing setup of the current **<Manufacturer>** and **<Model>** selections. Only **<Manufacturers>** and **<Models>** selected from the drop down list can use this feature. A list of matching setups displays in the **[Setup Selector]**. Choose the setup that corresponds most closely to the device that you are setting up. The settings specific to the device update in the editor. The only requirement is to specify unique characteristics of the device such as serial number, identification, and customer number. Also specify any unique communications settings associated with the device: IEEE-488, RS232 Port and settings, etc. **DHI** maintains and updates a list of supported devices that can be downloaded from the **www.dhinstruments.com**. Each setup contains all details required to use the device in **COMPASS**. This includes supported final outputs and parsing protocols, commands to read and set outputs, and default communications settings for the device. In addition to **DHI** provided examples, all previous hardware component setups can be used. However, the **[Find Previous Setup]** feature is not required in this case. Simply use the Editor Toolbar, Setup Selector feature and locate the desired device. Then use the Editor Toolbar, **[Copy]** icon to copy all setup entries. In this case, serial number, identification, and customer ID values are copied as well.
Auto Detect Setup (conditional check box available for device editors only when the <Manufacturer> is **DHI** and the <Model> is a known **DHI** product)	This feature is available for setups of **DHI** products. Checking this option allows **COMPASS** to use built-in device monitoring and control features. Read and Set information is not required. Do not check this box if you wish to manually specify Read and Set capabilities of a **DHI** product. **DHI** products that use this feature display their output on Device Output Screens. Features to control, monitor and change the state of the device are provided. Checking this feature allows **COMPASS** to send test initialization information to a device when initializing a test. This includes setting the selected range, head medium and height, stability and hold limits, as well as the selected Piston-Cylinder, Mass Set and Mass Bell settings for a PG7000. *Check this option to use all of the advanced features of a DHI product without the need to specify remote commands.*
Serial Number (optional text entry field)	Write in the device serial number. The field can contain any combination of characters and numbers to represent a specific device. The value entered is included in the Test Data Files and can be included in reports. DUTs whose record type is **<Profile>** do not include a serial number in the DUT Editor. Instead, the serial number can be entered during test initialization. The default Data File directory naming preference can use the DUT **<Serial Number>** to create the data directory for date files when running tests.
Identification (optional text entry field)	Write in the device identification. The field can contain any combination of characters and numbers to represent a specific device. This field is frequently used to store internal tracking information for a specific device. The value entered is included in the Test Data Files and can be included in reports. DUTs whose record type is **<Profile>** do not include an identification field in the DUT Editor. Instead, the identification can be entered during test initialization. The default Data File directory naming preference can use the DUT **<Identification>** to create the data directory for date files when running tests. *The DUT (UUT) asset number must be entered in this field to import a COMPASS data file into MET/CAL®. The value is used to synchronize MET/CAL DUT information with COMPASS DUT information (see 22, Export to MET/CAL).*
Customer ID (optional text entry field)	Write in the device customer identification. The field can contain any combination of characters and numbers to represent a specific device. This field is frequently used to store customer specific product information. The value entered is included in the Test Data Files and can be included in reports. DUTs whose record type is **<Profile>** do not include a customer ID in the DUT Editor. Instead, the identification is entered during test initialization. The default Data File directory naming preference can use the DUT **<Customer ID>** to create the data directory for date files when running tests.

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FEATURE	DESCRIPTION
This device can be used as a DUT (optional check box; non-DUT device editors only)	Check this option to allow the final output of a device to be used as a DUT output. This will allow the device to be the device under test when a test is run. In some cases, this is desirable (for example a pressure reference needs to be a DUT when it is calibrated). To allow the device to be used as a DUT, check this option and create a second final output specified as DUT Pressure. During Test Initialization, the output specified for DUT Pressure will be listed along with other DUTs in the database.
Platform Type (required drop down list selection; Piston Gauge Platform editor only)	Select the type of Piston Gauge Platform. There are two choices: **Piston Gauge** — When this platform is used, the pressure output will be will be calculated from mass load and piston-cylinder effective area using the complete pressure equation. Platforms of this type can only be used with Piston-Cylinders and Mass Sets that are also defined as **<Piston Gauge Type**>. **Deadweight Tester** — When this platform is used, the pressure output is calculated using the pressure values specified for the piston-cylinder and the masses in their definitions. A gravity correction for the difference between the gravity specified in the element definitions and the local gravity is also applied. Platforms that are specified as Deadweight Tester can only be used with Piston-Cylinders and Mass Sets that are also defined as a Deadweight Tester. **DHI** PG7000s should never use this selection. *DHI PG7000s do not use this option when <Auto Detect Setup> is checked. In this case, the PG7000 is remotely queried for mass load and pressure information when running tests. COMPASS performs no metrological calculations related to the piston gauge.*
Piston- Cylinder Type (required drop down list selection; Piston-Cylinder editor only)	Select the type of Piston-Cylinder. There are two choices: **Piston Gauge** — The piston-cylinder is defined in terms of effective area and will be used with a **<Piston Gauge>** type Platform. **Deadweight Tester** — The piston-cylinder is defined in terms of the corresponding pressure when it is floated at a specified gravity and will be used with a **<Deadweight Tester>** type Platform. The setup choices of the **<Piston-Cylinder Editor>** editor change based on this selection.
Mass Set Type (required drop down list selection; Mass Set editor only)	Select the type of Mass Set. There are three choices: **Piston Gauge** — The mass set is defined in terms of the true mass in kilogram of each mass and will be with a **<Piston Gauge>** type Platform. **Deadweight Tester** — The mass set is defined in terms of the corresponding pressure when each mass is floated on a specific piston at a specified gravity and will be used with a **<Deadweight Tester>** type Platform. **Piston Gauge Trim Mass** — Defines a trim mass set to be used with a Piston Gauge type mass set a **<Piston Gauge>** type mass set and a **<Piston Gauge**> type platform. This is for small masses (usually < 100 g) whose true mass value is assumed to be equal to the nominal value. The setup choices of the **<Mass Set Editor>** change based on this selection.

4.3.4 [CALIBRATION] TAB

The **[Calibration]** tab is common to the definition editor for all device setups in **COMPASS**. This includes DUT, Support Device, Piston Gauge Platform, Piston-Cylinder, Mass Set and Mass Bell Editors. The fields on this tab are used to include information specific to the device's calibration in its definition. **COMPASS** provides features to limit the use of setups that are "out of calibration." The **[Calibration]** tab information is also available on reports.

Not all features of the **[Calibration]** tab are available on all **COMPASS** Editors. **Table 9** describes the **[Calibration]** tab features. The Feature column notes features that are not available in certain setup types.

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All features on the [Calibration] tab are optional. The information is provided for calibration tracking. The last edit and the active user for the edit are always provided on this tab in the <Record Last Edited> and <Record Last Edited By> fields.

Use the <Calibration Setting> fields to store calibration settings for an instrument. Not only is this information available for reporting, the values (or text) are available to COMPASS Relationship Macros. The Relationship Macro can apply the calibration data to the output of the instrument to obtain a fully compensated final output (see 18.5.5, Relationship Macros). The user controls the format and use of the data.

Calibration information is entered for a device and not a specific final output. This is because in most cases, all calibrated quantities of an instrument are calibrated at the same time. If this is not the case, make sure that the calibration information entered corresponds to the output that must be calibrated next.

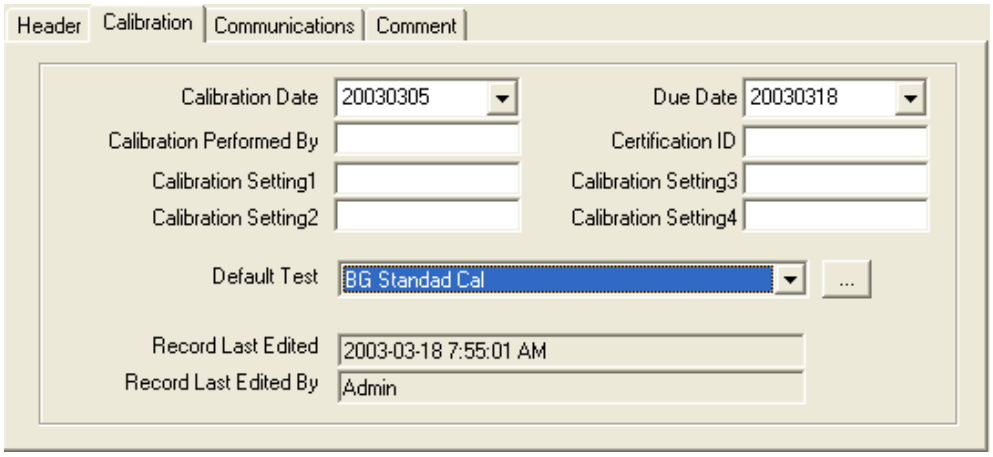

Figure 16. DUT Editor, **[Calibration]** Tab

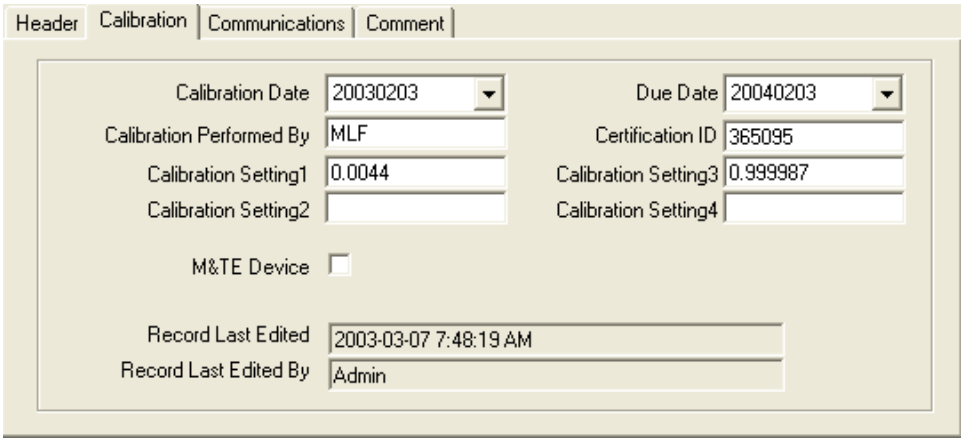

Figure 17. Support Device Editor, **[Calibration]** Tab

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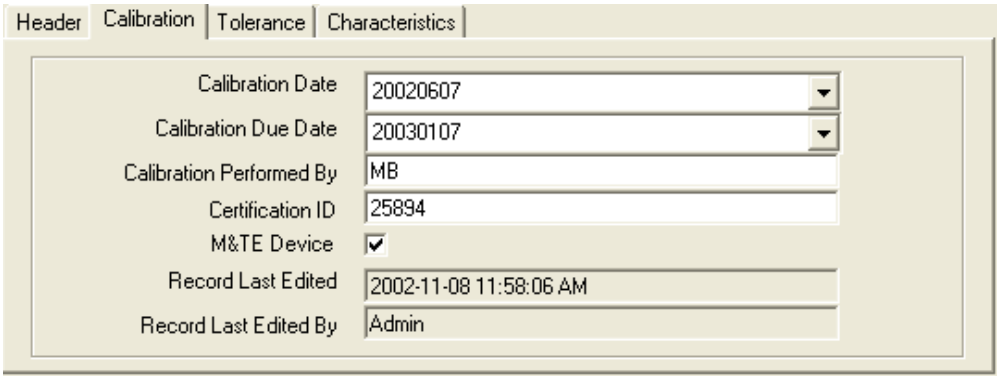
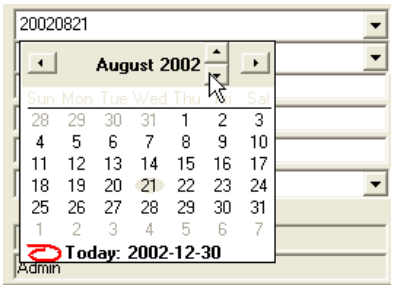


Figure 18. Piston-Cylinder Editor, **[Calibration]** Tab

Table 9. Device Editor, **[Calibration]** Tab Fields

FEATURE	DESCRIPTION
Calibration Date (optional calendar selection)	Enter the calibration date of the instrument. In most cases, the date of the last calibration should be entered. The date is always formatted according to the host computer's short date format selected in the Windows™ Control Panel under Regional Settings. Press the down arrow to select the date by using a calendar. Use the horizontal scroll bars to change months. Click the year at the top of the calendar to display a vertical scroll bar. Use this scroll bar to select the year  **Figure 19.** Date Selection
Calibration Due Date (optional calendar selection)	Use the calendar selector to specify the next calibration date of the device. If this date is less than the current test date, **COMPASS** considers the devices "out of calibration". Use preferences on **[Tools]**, **[Options]**, **[Initialize Test]** to prevent devices that are out of calibration from being used as references in tests.
Calibration Performed By (optional text entry)	Identify the user that performed the calibration of the device.
Ceritifcation ID (optional text entry)	Enter any relevant document tracking information associated with the **<Calibration Date>**. The information entered is available on calibration reports.
Calibration Setting1 (optional text/numeric entry)	Enter calibration coefficients or settings specific to the output of an instrument. The data can be text or numeric. There are no specific formatting requirements. The field is frequently used to store adder and multiplier values of a device. Both coefficients can be added to one field or added to more than one **<Calibration Settings>** field. If desired, this data can be applied to the device real time by using a Relationship Macro (see 18.5.5, Relationship Macros)
Calibration Setting2 (optional text/numeric entry)	See **<Calibration Setting1>**.
Calibration Setting3 (optional text/numeric entry)	See **<Calibration Setting1>**.

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FEATURE	DESCRIPTION
Calibration Setting4 (optional text/numeric entry)	See **<Calibration Setting1>**.
M&TE Device (optional check box entry)	Check this box to identify the device as a Measurement and Test Equipment device. **COMPASS** provides features so that only devices identified as M&TE can be used as sources of reference pressure. This helps to limit the number of devices in the list of reference measurement related quantities.
Default Test Definition (optional drop down list; DUT editor only)	Select the default test to execute when the DUT is selected. The selection can be made from the drop down list of Test Definition Record Labels or press the button next to the field to access the Test Definition Selector. During Test Initialization, the test specified here is selected by default. This is a simple means of linking a DUT with a testing procedure. Choose **<None>** to remove any DUT and Test relationship.
Record Last Edited (display only)	The user that was actively logged into **COMPASS** when the device definition being edited was last modified. This field is used for display purposes only. **COMPASS** updates this field automatically when appropriate when changes are saved.
Record Last Edited Date (display only)	The date of the last edit of the device. This field is used for display purposes only. **COMPASS** automatically updates this field when changes are saved. Changes to metrological elements such as piston-cylinders can adversely impact pressure measurement using **COMPASS**. Use this field to determine the last time a setup was changed and to troubleshoot problems associated with changes in the **COMPASS** setup.

4.3.5 [COMMUNICATIONS] TAB

The **[Communications]** tab is common to the definition editor for all device setups in **COMPASS** that have outputs or sets. This includes DUT, Support Device and Piston Gauge Platform Editors.

Select the desired data acquisition type and enter the settings appropriate for the selection. By default, **COMPASS** will perform all communications with the device following the data acquisition type specified. Automated remote interfaces such as IEEE-488 and RS232 require remote commands to be setup for each raw output or raw set of the device. Use the **[Header]** tab, **[Find Previous Setup]** function to reuse devices that have already been set up and/or to check whether the device under set up is already included in the device database (see 4.3.3, [Header] Tab).

To use **COMPASS** features correctly, the **[Communications]** tab settings should always correspond to the actual output of the device, not of a support device that may be required. For example, for a DUT that outputs a voltage the remote interface of the DMM used to measure voltage should NOT be specified here. Rather, select **<Other Device>** for **<Data Acquisition Type>** of the DUT and setup the DMM separately using the **Support Device Definition Editor**. On the **[Communications Tab]** of the DMM's setup, specify the remote interface to the DMM with a Final Output of Voltage. The DUT raw output source must be set to **<Voltage Measurement>**. When **COMPASS** tests this DUT, it will identify it as having a voltage output and use the DMM to read the voltage. This implementation allows the DMM to be used at other times in **COMPASS** to read voltage or other signals without redefining the remote interface for each use. It also simplifies changes related to the DMM since it only needs to be changed in its Support Device Definition, not for each DUT that uses it.

There are occasions in which a support device is dedicated to a specific measurement or control device. For example, a DUT may be "married to" a specific signal conditioner. In this case, the signal conditioner can be considered part of the DUT included in the DUT Definition. Therefore, the remote commands for the conditioner should be specified with the DUT Definition.

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For advanced DUTs and support devices, this tab provides support of independent interfaces for measurement and control. To set up for a device to use separate measurement and control interfaces uncheck the **<Common Set and Read Interface>**. When this feature is unchecked, separate interface frames for an **<Output Interface>** and a **<Set Interface>** are displayed.

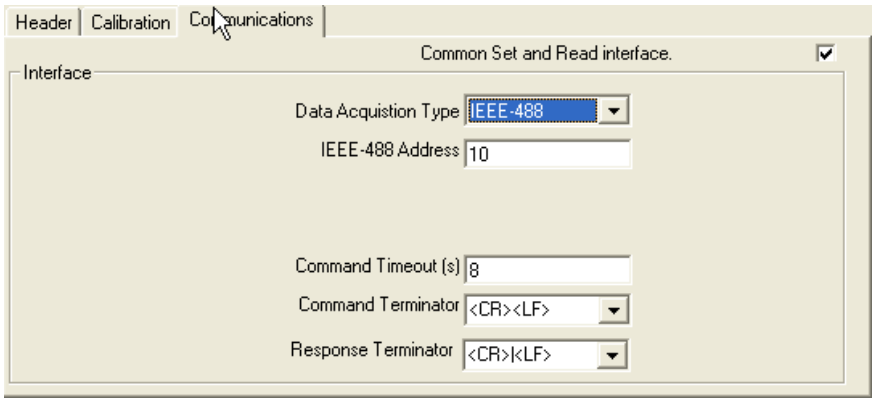

Figure 20. Common Read and Set Interface Setups on the **[Communications]** Tab

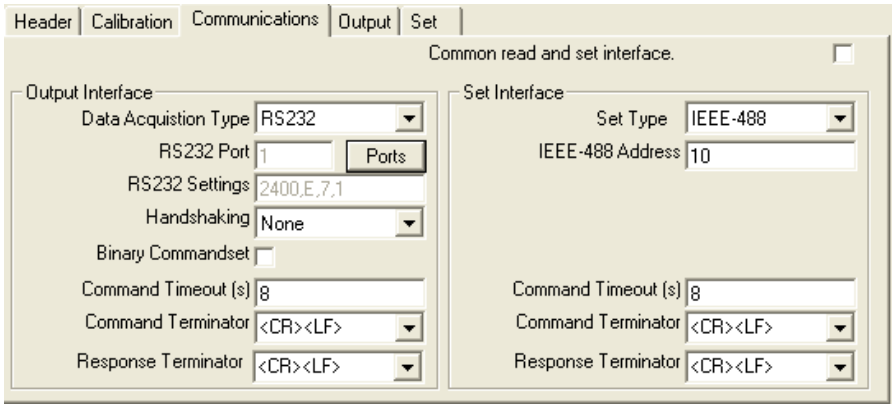

Figure 21. Individual Read and Set Interface Setups on the **[Communications]** Tab

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Table 10. Device Editor, **[Communications]** Tab Fields

FEATURE	DESCRIPTION
Common Set and Read Interface (conditional check box selection)	Un-check if a device has both output and set capabilities AND the two capabilities are addressed on different interfaces. If this feature is not checked, independent Output and Set interfaces must be completed. By default, this feature is checked. This feature is not available with simple type DUTs and when the <Autodetect setup> feature is checked on the [Header] tab.
Data Acquisition Type (required drop down list selection)	Defines how read and/or set values will be communicated to and/or from the device. Each choice requires unique settings to be entered. See Section 23 for additional details on remote communications in **COMPASS**. The available **<Data Acquisition Types>** are: **Manual** — Output values are entered manually by the operator and/or set values are executed manually by the operator. No further selections on the **[Communications]** tab are necessary. **RS232** — Read and/or set values will be communicated remotely using an RS232 interface. Settings specific to the RS232 interface must be complete on the tab. Remote commands to read and/or set with the device are setup on the **[Output]** and/or **[Set]** tabs. Refer to section 25.2, **RS232 Interface** for information on RS232 settings and options. **HART via RS232** — Read data by using an RS232 to HART converter as the remote interface (see 25.5, HART via RS232). Settings specific to the RS232 interface must be complete on the tab. Remote commands are defined internally by **COMPASS** by using the HART protocol. No remote command setup is required. This option is cannot be used for controlling devices. **IEEE-488** — Read and/or set values will be communicated remotely using an IEEE-488 interface. Remote commands to read and/or control with the device are setup on the **[Output]** and/or **[Set]** tabs. Remote commands to read and/or set with the device are setup on the **[Output]** and/or **[Set]** tabs. Refer to section 25.3, **IEEE-488 interface** for details on the IEEE-488 interface and settings. The active IEEE-488 interface card manufacturer is selected in **[Tools**,**[Options]**,**[Interface]** (see 14.11). **TCP/IP** — Read and/or set values will be communicated remotely using a TCP/IP interface. Remote commands to read and/or set with the device are setup on the **[Output]** and/or **[Set]** tabs. Refer to section 25.4, **TCP/IP** for details on the TCP/IP remote settings. **Macro** — Measurement and/or control aspects of the device are accessed using an Interface Macro selected on the **[Output]** and/or **[Set]** tabs (see 18.5.4, Interface Macros). Macros used to read the instrument are called at the rate specified by the **<Poll Interval>**. Set macros are called for each new set command. The macro should communicate with the instrument by accessing interface code directly entered into the **COMPASS** Macro Editor or by calling other ActiveX programs. **Other Device** — A separate support device such as a DMM will be used to obtain the output of the device. No further selections on the **[Communications]** tab are necessary.
Poll Interval(ms) (conditional numeric entry)	This field is available for **<Macro>** data acquisition types only. The value entered represents the time interval between **COMPASS** calls to the selected Interface Macro. Although the entry is in ms, an effective time resolution of 250 ms is used by **COMPASS** to prevent degradation in **COMPASS** performance. Every 250 ms, checks to see if the interval has been exceeded. Therefore a 0 entry is valid.
Handshaking (conditional listbox selection)	This feature is available for RS232 interfaces only. Select the devices handshaking protocol to use with the interface. Handshaking refers to the internal communications protocol by which data is transferred from the hardware port to the receive buffer. The default selection is **<None>**. This selection is valid for the majority of remote devices. **None** — There is no RS232 handshaking required. **RTS/CTS** — Request to Send/Clear To Send handshaking. **XON/XOFF** — XON/XOFF Handshaking **RTSXON/XOFF** — Both Request to Send/Clear To Send and XON/XOFF Handshaking **RTS ON/OFF** — The PC RTS output is set to HIGH while sending data and set to low when the data transmission is complete. This handshaking option is required by some RS232 to HART converters.

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FEATURE	DESCRIPTION
RS232 Port (button Option)	The RS232 port that the PC will use to communicate with the remote device. Change the selection by pressing the **[Ports]** button. Do not confuse this port selection with the ports available on a remote device. For example a PPC3 has a COM1 and a COM2 port. This port selection does not refer to either of these ports. It refers only to the port on the HOST PC that will be used to communicate with the PPC3. This option is available only when the **<Data Acquisition Type>** is RS232 or HART RS232. The
RS232 Settings (button Option)	The RS232 settings of the remote device. The value is listed as: Baud Rate, Parity, Data Bits and Stop Bits. The field must be set to the settings defined by the remote device. Refer to the device manual for information on how to obtain the proper RS232 settings. When incorrect settings are used, proper communication is not possible. Change the selection by pressing the **[Ports]** button. This option is available only when the **<Data Acquisition Type>** is RS232 or HART RS232. The
Binary (conditional checkbox selection)	This feature is available for RS232 interfaces only. Check this box when the RS232 instrument requires binary communications instead of ASCII based communications. Instruments that use non printable commands sets that include "check sums", typically require this option to be checked.
Command Timeout(s) (numeric entry; remote interface **<Data Acquisition Type>** only)	The maximum length of time for the device to wait for a response from a remote command. If a response is not received within this amount of time, a **COMPASS** timeout occurs.
Command Terminator (text entry/drop down list selection; remote interface **<Data Acquisition Type>** only)	Defines how the device terminates command strings. The selected (or entered) value is automatically appended to the end of every command issued. Make sure that the terminator is not also included in the remote command setup. The selections available from the drop down list are: **<CR>** Carriage return, ASCII character 13 **<LF>** Line feed, ASCII character 10 **<CR><LF>** Carriage return line feed, ASCII characters 13 and 10. This is the most common selection and is selected by default.
Response Terminator (text entry/drop down list selection; remote interface **<Data Acquisition Type>** only)	Defines when **COMPASS** will consider an individual response to be complete. This option is not available in IEEE-488 communications. With IEEE-488 there are hardware level assertions that define the end of a command and response. The selections available from the drop down list are: **<CR>** Carriage return, ASCII character 13 **<LF>** Line feed, ASCII character 10 **<CR><LF>** Carriage return line feed, ASCII characters 13 and 10. This is the most common selection and is selected by default. **<CR>|<LF>** Carriage return **OR** line feed must be detected in the device response. ASCII characters 13 or 10. **>#** Read at least "#" characters from the RS232 buffer before assuming the response is complete. No physical buffer limitations are imposed. When # characters are received from the remote device the response data is used by **COMPASS**. This type of termination is useful when a final character is not used to mark the end of a response. **<#** **COMPASS** limits the RS232 buffer to # characters. When the buffer is full the response is considered complete and the data in the buffer is used by **COMPASS**. This type of termination is useful when the remote response is always a fixed number of characters. **""** Delete all text in the field to not use a response terminator. Do not enter empty quotes. **COMPASS** assumes that any response is complete when data has been retrieved from the remote device and new data is not received for 300ms. If no data is returned from the device a Timeout error occurs. This is really a safety feature, to prevent false device time-outs in the many devices that do not have a specific **<Response Terminator>**.

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4.3.6 [OUTPUT] TAB

The **[Output]** tab is common to the definition editor for all device setups in **COMPASS** that have outputs. This includes DUT, Support Device and Piston Gauge Platform Editors.

The features on the **[Output]** tab are used to define a device's final outputs. Final output creation is not required for all devices. Piston Gauge Platform Definitions do not require a final output setup, nor do **DHI** products created with the **<Auto Detect Setup>** option selected.

See 3.3, Device (instrument) Support Concept, to get a thorough understanding of how COMPASS handles devices and final outputs. An understanding of this topic is critical to proper setup of the [Output] tab.

With the exception of simple type DUT Definitions, the features on the **[Output]** tab are the same for all device setups. Press the **[Add]** button to create a new final output for the device or press the **[Edit Final Output]** button to edit an existing final output. Final output defining information is entered on the **Output Relationship Editor** that appears when adding or editing a final output (see 4.3.6.2, Output Relationship Editor). If necessary press the **[Edit Commands]** button to modify or create remote commands required to read the raw output from the device. The fully formatted remote commands must result in a numeric output in the **<Raw Output Unit>** specified on the **Output Relationship Editor**, **[Raw Output]** tab. The Remote Command Editor provides features to handle this operation (see 4.4, Remote Command Editor).

When defining remote commands for a particular output, use Initialization Commands as needed to set the device to the state expected by the Output Relationship Editor setup. It is expected that the response to the command is in the **<Raw Output Unit>**. Initialization commands can be used to assure the device is set to output in the correct unit of measure. In some cases, an output may correspond to a specific range of a device. Again, use initialization commands to set this range.

With few exceptions, **COMPASS** does not limit the type of final outputs that can be created for a device, nor does it limit the number of final outputs that a device can support. Create as many final outputs as desired and appropriate for the device. Remove final outputs by pressing the **[Remove]** button.

DUT Definitions of simple type DUTs have a simplified [Output] tab and Output Relationship Editor.

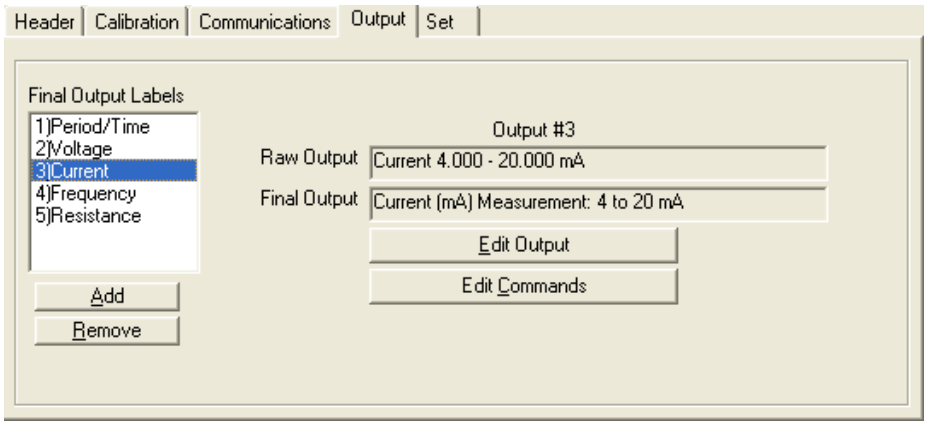

Figure 22. Device Editor, **[Output]** Tab

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Table 11. Device Editor, **[Output]** Tab Fields

FEATURE	DESCRIPTION
Final Output Labels (display list box)	Contains a list of final outputs available from a device. Final outputs are added and removed using the **[Add]** and **[Remove]** buttons. Select a final output and select **[Edit Final Output]** to modify a final output's information. This causes the Output Relationship Editor to load. Select **[Edit Commands]** to create or modify remote commands associated with the final output.
Add (button)	Press this button to create a new final output. The Output Relationship Editor displays to allow the final output information to be edited.
Remove (button)	Press this button to remove the final output selected in the **<Final Output Labels>** list. The **[Undo]** button on the Editor Toolbar can be used to restore a deleted final output until the record is saved.
Raw Output (label)	Displays raw output information corresponding to the final output label selected in the **<Final Output Labels>** list.
Final Output (label)	Displays final output information corresponding to the final output selected in the **<Final Output Labels >** list.
Edit Final Output (button)	Press this button to edit the information associated with the final output selected in the **<Final Output Labels>** list. The Output Relationship Editor displays. *Double-clicking the <Raw Output> or <Final Output> fields is an alternate way to open the Output Relationship Editor*
Edit Commands (button)	Press this button to open the Remote Command Editor to edit remote commands specific to the raw output from the device that is used to arrive at the final output selected in the **<Final Output Labels>** list. Only final outputs that use a raw output that requires remote communication with the device require remote commands. Commands set up are Output Commands and should output in the output unit specified in the Output Relationship Editor, **[Raw Output]** tab.

4.3.6.1 [OUTPUT] TAB FOR SIMPLE TYPE DUTS

The DUT Device Editor, **[Output]** tab for simple type DUTS contain an abbreviated version of the settings available on the Output Relationship Editor. A simple DUT is limited to a single final output of DUT Pressure. Directly enter or select all relevant settings.

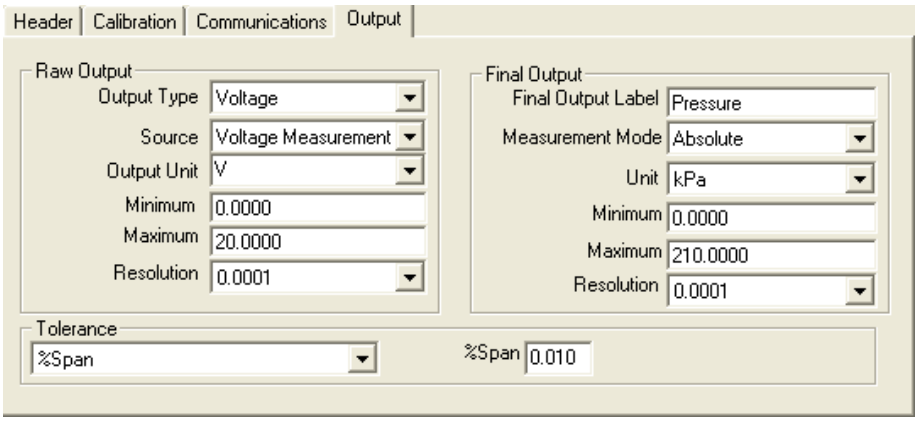

Figure 23. DUT Device Edit **[Output]** Tab for a Simple Type DUT

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4.3.6.2 OUTPUT RELATIONSHIP EDITOR

DHI device definitions setup using the <Auto Detect Setup> do not require the use of the Output Relationship Editor. All commands and supported outputs and sets are handled by COMPASS.

Final outputs are created using the features on the Output Relationship Editor. Access this editor from any Device Editor, **[Output]** tab by pressing the **[Add]** button to create a new final output or pressing the **[Edit Output]** button to edit an existing final output.

See 3.3, Device (instrument) Support Concept, to get a thorough understanding of how COMPASS handles devices and final outputs. An understanding of this topic is critical to proper use of the Output Relationship Editor.

The purpose of the Output Relationship Editor is to identify a device's raw output(s) and define how the raw output(s) corresponds to the final output. For example, a pressure transducer normally has a final output of DUT Pressure, however it may have a raw output of Voltage. In some cases the raw output is the same as the final output. This is the case when a device has a remote interface and the remote commands used to interface with the device respond directly with the desired final output. In other cases, significant manipulation of one or more raw outputs is necessary to obtain the final output. There are several built-in **<Raw Output to Final Output>** conversion selections provided to cover the most common relationships. In addition, a **COMPASS** Relationship Macro can be used for high level manipulation of raw output(s) as needed to obtain a final output (see 18.5.5, Relationship Macros).

In addition to defining the relationship of raw outputs to final outputs, final output tolerance information is also specified on the Output Relationship Editor, **[Tolerance]** tab. A variety of different tolerance types and ranges can be defined for any final output. The tolerance information created in this editor is used to determine the output tolerance displayed on the Device Run Screen for the device and on the Comparison Run Screen if the device is a DUT.

The <Final Output Label> on the [Final Output] tab is used to identify a final output for selection during Test Initialization and when creating Test Definitions. Always enter a label that will be easily recognized when selecting output sources. For devices that have multiple final outputs, be sure the label describes the specific output being set up. For example, use "Pressure Range 1" rather than just "Pressure "on a device with several ranges.

To define a final output using the Output Relationship Editor, always make selections on its **[Raw Output]** tab first, then the **[Final Output]** and finally the **[Tolerance]** tab. Selections on each tab can impact the selections available on other tabs. Making selections in tab order will prevent confusion. The following sections and Tables provide detailed information on using the Output Relationship Editor.

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4.3.6.2.1 [Raw Output] Tab Setup Procedure

This section describes the features associated with the Output Relationship Editor, **[Raw Output]** tab. A step by step tab completion process is detailed below. Table 7 provides detailed information on the tab fields and options.

See 3.3, Device (instrument) Support Concept, to get a thorough understanding of how COMPASS handles devices and final outputs. An understanding of this topic is critical to proper use of the Output Relationship Editor.

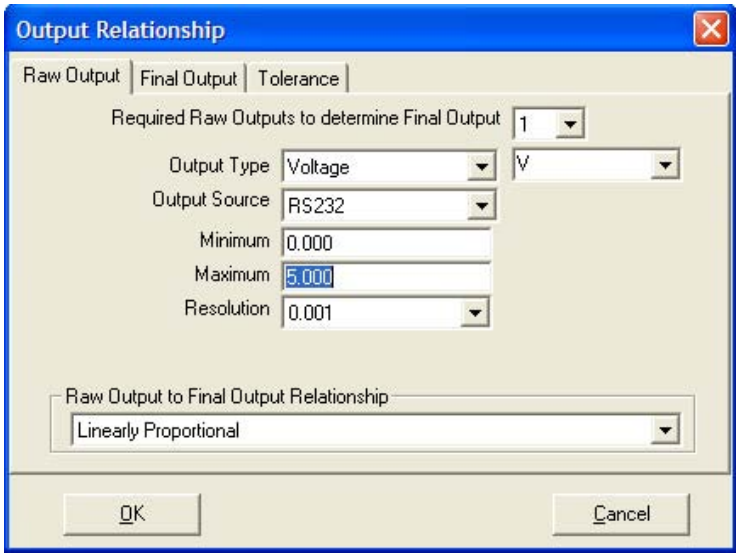

Figure 24. Output Relationship Editor, **[Raw Output]** Tab

❶ Open the Output Relationship Editor from the Device Editor, **[Output]** tab and select the **[Raw Output]** tab.

❷ Select the number of raw outputs required to arrive at the final output. This is typically one. However, some devices may require more than one raw output to arrive at final output. A final output of another device, may serve as a raw output for a different final output. For example, voltage output pressure sensors may also output temperature and have a temperature dependency. In this case, two raw outputs are required, one is voltage the other is temperature. Temperature is the final output of another **COMPASS** Support Device. When more than one raw output is used a **COMPASS** Relationship Macro is required to arrive at the final output. If the number of outputs is greater than one, the **[Raw Output]** tab choices no longer include the **<Minimum>** and **<Maximum>** output values (see the figure below).

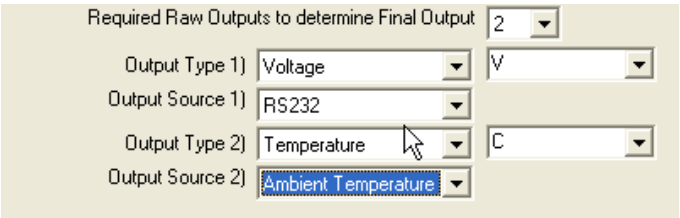

Figure 25. More Than One Raw Output on the **[Raw Output]** Tab

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❸ Select the **<Output Type>** and corresponding unit of measure. The **<Output Type>** is a broad classification of outputs that determines the available **<Output Sources>** (see **Table 12** for a list of Output Types and corresponding Output Sources). The selection specifies the **<Raw Output>** as a pressure, temperature, voltage, etc. The unit of measure specified is the unit in which the **<Raw Output>** must be acquired by the selected **<Source>**. This is the **<Raw Output Unit>**.

❹ Select the **<Output source>** to specify how **COMPASS** will obtain the raw output. The choices available are the device itself (manual or its remote interface) or another device identified by the final output type. THE NORMAL SELECTION IS THE DEVICE ITSELF (MANUAL OR ITS REMOTE INTERFACE). When the choice is manual entry or a remote interface, the device's output must be entered or acquired in the selected **<Output Type>** unit. This requires manual entry in that unit or that the response to remote commands is in that unit. When a Support Device final output is selected as the **<Output source>**, **COMPASS** handles all necessary unit conversions.

Device based <Output Source> selections do not require a specific device selection at this step. The actual source device is determined by the Test Definition or is selected during Test Initialization (see 7.3.5, Verify/Select Test Hardware). For example, for a voltage output pressure transducer, <Voltage Measurement> is selected as the <Output Source>. During Test Initialization, the actual voltage measurement device is selected. The default devices used throughout COMPASS to supply final outputs and sets are specified using the [Default Hardware Configuration] (see 12, [Setup], [Default Hardware Configuration].

❺ If not using multiple raw outputs go to ❻. If using multiple raw outputs, repeat ❸ and ❹ for each of the raw outputs. Then proceed to ❽.

❻ Enter the **<Minimum>** and **<Maximum>** output values. This determines the raw output span. Depending on the **<Raw Output to Final Output Relationship>**, the values entered may be used to determine the final output. In some cases, the actual **<Minimum>** and **<Maximum>** entries are not relevant. For example, when setting up a resistance output of a DMM, the raw output and final output typically have a relationship of **<Same>**. Therefore, no manipulation between raw output and final output occurs. As a result, there is no need to enter a specific resistance range. The only restriction is that the entries are not the same to avoid a span of 0.

❼ Select the **<Resolution>** to use when displaying, logging and reporting the raw output. Use a resolution appropriate for the device and it's tolerance.

❽ Select a **<Raw Output to Final Output Relationship>**. This selection determines how the raw output will be manipulated to obtain a final output. If the device raw output is the same as the final output (for example a digital pressure monitor that outputs pressure directly with no manipulation needed), the selection is **<Same {Raw Output = Final Output}>**. Devices that do not output the final output directly, most often use **<Linearly Proportional>**, this is the case for most voltage output transducers.

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❾ Proceed to the **[Final Output]** tab.

Detailed information on all selections of the **[Raw Output]** Tab are provided in Table 7.

Table 12. Output Relationship Editor**, [Raw Output]** Tab Fields

FEATURE	DESCRIPTION
Required Raw Outputs to Determine Final Output (required drop down list selection)	Select the number of raw outputs that are required to calculate the final output. By default, the selection is **<1>**. When more than one is selected, a **COMPASS Relationship Macro** is required to handle the manipulation of multiple outputs to arrive at a final output. When required raw outputs is more than one, the **[Raw Output]** tab display choices also change to allow only **<Output Type>**, **<Source>** and **<Unit>** selections for each of the raw outputs. More than one output is required for final outputs that have a complex raw output to final output relationship. During Test Initialization, the specific devices to use as sources for these raw outputs are selected (see 7.3.3, Configure DUT(s)/Devices). Using a **Relationship Macro** in the **COMPASS Relationship Macro**, the outputs of these devices are combined and converted to the final output of the device (see 18.5.5, Relationship Macros). *COMPASS for Pressure Basic does not support multiple raw outputs or COMPASS Macros.*
Output Type (required drop down list selection)	Select the output type of the numeric output of the raw output. This selection describes the general type of the output. The choice updates the available units of measure and **<Output Source>** selections for the raw output.
Raw Output Unit (required text entry/list selection)	Select or enter the unit of measure in which the raw output will be obtained. When manually entering the raw output, or using remote commands to read the raw output, the values must be acquired in the unit specified in this field.
Output source (required list selection)	Select the source of the raw output. The available choices are determined by the **<Output Type>** selection and the settings on the **[Communications]** tab of the device's definition. When more than one raw output is specified in the **<Required Raw Outputs to Determine Final Output>** field, there is an **<Output Source>** field for each raw output. Make a selection in each field.
Minimum (conditional numeric entry)	Enter the minimum raw output in the specified **<Output Type>** unit. This field is not available when more than one raw output is specified in the **<Required Raw Outputs to Determine Final Output>** field. When the selected relationship is **<Same>**, the actual entry in this field is not used for calculation purposes.
Maximum (conditional numeric entry)	Enter the maximum raw output in the specified **<Output Unit>** unit.. This field is not available when more than one raw output is specified in the **<Required Raw Outputs to Determine Final Output>** field. When the selected relationship is **<Same>**, the actual entry in this field is not used for calculation purposes.
Resolution (required list box selection)	Set the resolution with which the **<Minimum>** and **<Maximum>** output entries display. This selection also determines the default resolution used in the run screens, logged to data files and reported in the **COMPASS** Report Editor.

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Raw Output to Final Output Relationship

(required drop down list)

Select the output relationship from the list. The selection determines how **COMPASS** will manipulate the raw output(s) to obtain the final output. There are several standard choices. In addition, all **COMPASS** Relationship Macros are included in the list. The choices are:

Same

No manipulation is applied to the raw output value. Use this choice for devices that directly output in their final output unit of measure. Typically, devices that have their own remote interface as the **<Output Source>** on the **[Raw Output]** tab use this selection. When this choice is selected, the **[Final Output]** tab settings are automatically set to be equivalent to the specified **[Raw Output]** tab settings.

Linearly Proportional

The measured raw output is converted to a percentage of the raw output span. This percentage is applied to the final output span to obtain the final output. Many pressure transducers that output in voltage use this selection: for example, 0 – 5V raw output corresponds to 0 to 100 kPa final output. The linearly proportional raw output to final output formula is:

$$F_{Final} = F_{Span}\left(\frac{O_{Raw} - O_{\min}}{O_{Span}}\right) + F_{\min}$$

VARIABLE	DESCRIPTION
F_{Fiinal}	Calculated final output in the **<Final Output>** unit.
F_{Span}	Final output span in the final output unit.
O_{Raw}	Un-manipulated raw output as entered or measured remotely.
O_{min}	The minimum raw output in the raw output unit.
O_{Span}	The raw output span in the raw output unit.
F_{min}	The minimum final output in the final output unit.

Inverse Square

Use this selection when the final output has an inverse square root relationship to the raw output. This relationship is not defined when the raw output is zero.

$$F_{Final} = \frac{1}{\sqrt{O_{Raw}}}$$

[Add Macro]

Select this choice to create or edit **COMPASS** Relationship Macros.

All other choices

Are labels identifying user created **COMPASS** Relationship Macros. Review the comments of these macros to determine their intended use if it is not implied by the macro name (see 18.5.5, Relationship Macros). Any level and type of manipulation can be performed within the macro.

The device remote interface and manual entry are always possible output sources regardless of the selected <Raw Output Type>. The actual device used as the output source is selected during Test Initialization (see 7.3.3, Configure DUT(s)/Devices).

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Table 13. Raw Output Type and Possible Output Sources

RAW OUTPUT TYPE	POSSIBLE OUTPUT SOURCES (OTHER THAN THE DEVICE ITSELF)
Current	A device that measures current (Amperes) is required to measure the output. The choices are: **Current Measurement**
Frequency	A device that measures frequency is required to measure the output. The choices are: **Frequency Measurement**
Humidity	A device that measures humidity is required to measure the output. The choices are: **Ambient Humidity**
Period/Time	A device that measures period/time is required to measure the output. The choices are: **Period/Time**
Position	A device that measures piston position is required to measure the output. The choices are: **Piston Position**
Pressure	A device that measures pressure is required to measure the output. The individual choices confine the list of available pressure measuring devices during test initialization. The choices are: **Ambient Pressure** — The raw output is the final output of a device whose final output is ambient pressure. **Reference Pressure** — The raw output is the final output of a device whose final output is reference pressure. **DUT Pressure** — The raw output is the final output of a DUT. **Reference Vacuum** — The raw output is the final output of a device whose final output is reference vacuum. **Line Pressure** — The raw output is the final output of a device whose final output is line pressure. **General Pressure** — The raw output is the final output of a device whose final output is general pressure. Any of the pressure output devices stored in the **COMPASS** database can be selected.
Resistance	A device that measures resistance is required to measure the output. The choices are: **Resistance**
Rotation	A device that measures rotation is required to measure the output. The choices are: **Piston Rotation**
Temperature	A device that measures temperature is required to measure the output. The individual choices confine the list of available temperature measuring devices during test initialization. The choices are: **Ambient Temperature** — The raw output is the final output of a device whose final output is ambient temperature. **Reference Temperature** — The raw output is the final output of a device whose final output is reference temperature. **Piston-Cylinder Temperature** — The raw output is the final output of a device whose final output is piston-cylinder temperature. **General Temperature** — The raw output is the final output of a device whose final output is general temperature. Any of the pressure output devices stored in the **COMPASS** database can be selected.

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RAW OUTPUT TYPE	POSSIBLE OUTPUT SOURCES (OTHER THAN THE DEVICE ITSELF)
User Defined	Any device in **COMPASS** can be used to measure the output. Use this choice only when none of the other selections are valid for a particular raw output. Typically, this selection requires the use of a **COMPASS Relationship Macro**. **COMPASS** does not perform unit conversions with the outputs of source instruments used with an instrument that has a **<User Defined>** raw output type. The choices are: **Auxiliary Device**
Voltage	A device that measures voltage is required to measure the output. The choices are: **Voltage Measurement**

4.3.6.2.2 [Final Output] Tab Setup procedure

This section describes the features associated with the Output Relationship Editor, **[Final Output]** tab. A step by step tab completion process is detailed below. **Table 14** provides detailed information on the tab fields and options.

See 3.3, Device (instrument) Support Concept, to get a thorough understanding of how COMPASS handles devices and final outputs. An understanding of this topic is critical to proper use of the Output Relationship Editor.

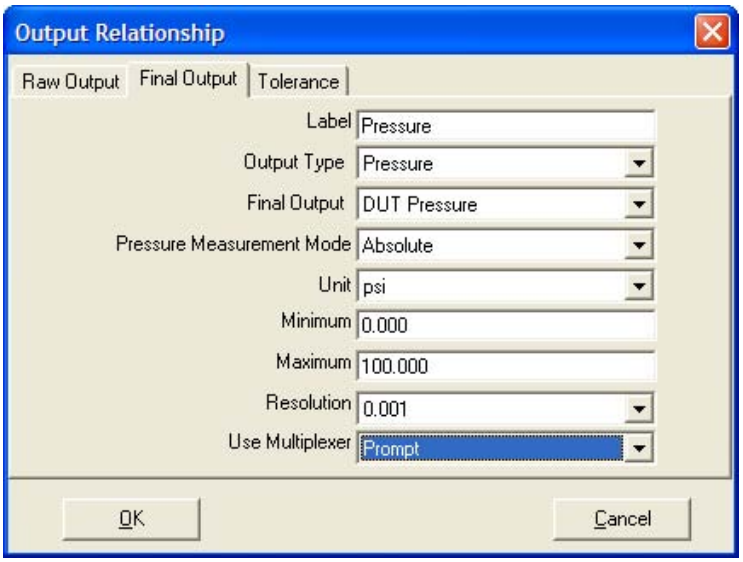

Figure 26. Output Relationship Editor**, [Final Output]** Tab

❶ Open the Output Relationship Editor from the Device Editor, **[Output]** tab and select the **[Final Output]** tab.

❷ Enter the **<Final Output Label>**. Features on **[Tools]**, **[Options]**, **[Initialization]** allow final outputs to be selected as identified by the value entered in this field (see 14.3, [Initialize Test] Tab). This label may also be used in Test Initialization. The label should clearly represent a specific final output in a device that has multiple final outputs. In many cases, a useful label is one that is equivalent to the **<Output Type>.**

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❸ Select the **<Output Type>**. The **<Output Type>** is a broad classification of outputs that determines the available **<Final Output>** selections.

❹ Select the **<Final Output>** to define for what function(s) the output will be used by **COMPASS**.

The <Final Output> selection ultimately determines for what purposes the device will be available when setting up and running tests. Table 15 lists the supported final output types.

❺ Select the **<Unit>** in which the final output is defined. **COMPASS** automatically converts from this output unit of measure to any required display or test unit of measure. Pressure final outputs also require a **<Pressure Measurement Mode>** selection.

❻ Enter the **<Minimum>** and **<Maximum>** output values. These determine the span and full scale of the final output.

❼ Select the **<Resolution>** to apply to the Final Output. The selection determines the resolution with which the final output is displayed and logged in the test Data File. Use a resolution appropriate for the device and its tolerance.

❽ Choose a **<Use Multiplexer>** option based on the requirements of the final output. In most cases, **<Never>** is the appropriate selection. However, there are cases in which linking the update of the final output to a specific channel on a multiplexing device is desirable. For example, a voltage output pressure transducer can be setup to use a specific multiplexer channel during Test Initialization. As a result, the voltage output is only updated when the selected multiplexer channel is active. Multiple transducers can be setup this way allowing a single voltage source to measure the output of each transducer by relying on the multiplexer to handle the channel switching.

❾ The **[Final Output]** tab settings are complete. Select the **[Tolerance]** tab.

Detailed information on all selections are provided in the **[Final Output]** Tab Fields Table (see **Table 14**).

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Table 14. Output Relationship Editor**, [Final Output]** Tab Fields

FEATURE	DESCRIPTION
Final Output Label (required drop down list selection)	A user defined label that describes the final output of the device. This label will be used to identify the specific final output of this device throughout **COMPASS.** In many cases, a useful label is one that is equivalent to the **<Final Output Type>**.
Output Type (required drop down list selection)	Select the type of the final output. This selection describes the general type of the output. The choice updates the available **<Final Output>** choices and units of measure for the final output.
Final Output (required list selection)	Select the final output. The available choices depend on the **<Output Type>** selection. The choice made in this field determines for what tasks this final output will be available for use in setting up and running tests.
Pressure Measurement Mode (conditional list selection)	Select the pressure measurement mode. This selection applies only to final outputs whose final d type is pressure. The choices are: **Absolute** **Absolute by ATM** (gauge pressure plus a separate measurement of atmospheric pressure) **Gauge**
Final Output Unit (required text entry/list selection)	Select or enter the unit of measure in which the Final Output is defined. **COMPASS** automatically converts this unit to the required test or display unit when running a test.
Minimum (conditional numeric entry)	Enter the minimum final output in the specified **<Final Output Unit>**.
Maximum (conditional numeric entry)	Enter the maximum final output in the specified **<Final Output Unit>**.
Resolution (required list box selection)	Set the resolution with which the **<Minimum>** and **<Maximum>** output entries display. This selection also determines the default resolution with which this final output is displayed and logged.
Use Multiplexer (optional list box selection)	Determines the association of reading the final output to the state of a multiplexer. The choices are: **Always** — During test initialization, the device must specify a multiplexer to use and a corresponding multiplexer channel **Sometimes** — An option to use a multiplexer is provided during test initialization. The selection is not required. **Never** — There is no choice to use a multiplexer during test initialization. *If a multiplexer is used, COMPASS does not attempt to read any of the raw outputs required to obtain the final output of the device until the selected multiplexer channel is activated. This feature is commonly used when defining a voltage pressure transducer.*

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Table 15. Final Output Types and Possible Final Outputs

FINAL OUTPUT TYPE	FINAL OUTPUT CHOICES	
Current	**Current Measurement**	The device is used to measure current (Amperes)
Frequency	**Frequency Measurement**	The device is used to measure frequency.
Humidity	**Ambient Humidity**	The device is used to measure ambient humidity.
Period/Time	**Period/Time Measurement**	The device is used to measure period/time.
Position	**Piston Position**	The device is used to measure piston position.
Pressure	The device can be used in any of several pressure measuring roles. If the device is frequently used for different types of pressure measurement, choose **<General Pressure>**.	
	Ambient Pressure	The device is used to measure atmospheric pressure.
	Reference Pressure	The device is used as the source of reference pressure values in a test or calibration.
	DUT Pressure	The device is a DUT. This selection is not available on support device setups that do not have DUT support enabled (see 4.3.3, [Header] Tab). This selection makes a device a DUT.
	Reference Vacuum	The device is used to measure reference vacuum (usually under a piston gauge bell jar).
	Line Pressure	The device is used to measure line pressure during a calibration or test.
	General Pressure	The device can be used in any and all pressure measurement roles.
Resistance	**Resistance**	The device is used to measure resistance.
Rotation	**Piston Rotation**	The device is used to measure rotation.
Temperature	The device can be used in any of several temperature measuring roles. If the device is frequently used for different types of temperature measurement, choose the **<General Temperature>** option.	
	Ambient Temperature	The device is used to measure ambient temperature.
	Reference Temperature	The device is used as the source of reference temperature values in a test or calibration.
	Piston-Cylinder Temperature	The device is used to measure the temperature of a piston gauge piston-cylinder.
	General Temperature	The device can be used in any and all temperature measurement roles.
Voltage	**Voltage Measurement** - The device is used to measure voltage.	

4.3.6.2.3 [Tolerance] Tab

The Output Relationship Editor, **[Tolerance]** tab is used to provide an uncertainty or error tolerance for a final output. The calculated tolerance displays on the Device Run Screen of the device when running a test and, if the device is a DUT, on the Comparison Run Screen. A red or green triangular indicator is used to indicate in or out of tolerance on these screens (see 5.5.2, DUT/Reference Comparison Run screen). The tolerance on a DUT final output is used to determine the status of a test point (in or out of tolerance) when running tests and to provide tolerance bars on plots.

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There are several tolerance formatting options. A different tolerance can be applied to up to four segments of the final output span. Use the selection appropriate for the final output.

%Reading only tolerances should be avoided if test points at or near 0 will be taken. The tolerance becomes infinitely small as the output approaches zero. Instead, use a combination tolerance to provide a low end threshold such as <%DUTFS OR %Reading (Greater of)>.

See Table 16 for detailed information on all **[Tolerance]** tab fields.

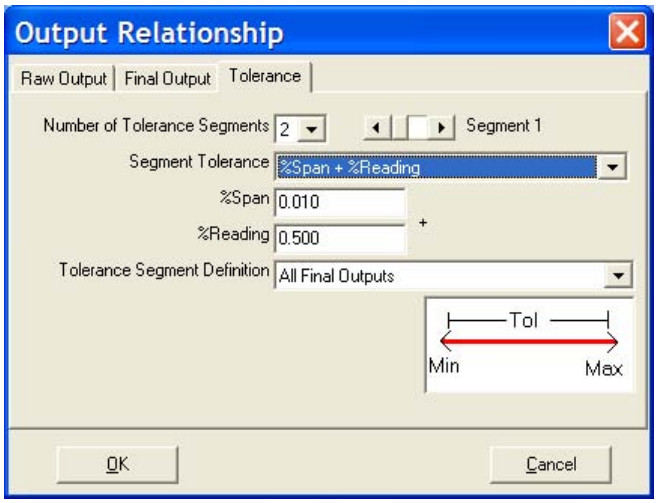

Figure 27. Output Relationship Editor, **[Tolerance]** Tab

Table 16. Output Relationship Editor, **[Tolerance]** Tab Fields

FEATURE	DESCRIPTION
Number of Tolerance Segments (required list selection)	Select the number of independent tolerance segments within the final output span. Most devices have one tolerance segment. For each segment, complete tolerance information must be specified. **COMPASS** uses segment specific tolerance information to determine the tolerance of a final output. The span segment over which each tolerance segment is applied is determined by the **<Tolerance Segment Definition>** selection. When a value greater than 1 is selected, a scrollbar appears next to the display. Use this scroll bar to select each tolerance segment (see **Figure 27**). The information on the **[Tolerance]** tab is displayed according to the active tolerance segment. *Use this feature to create more than one segment only when a compound tolerance definition is not adequate. For example, if the tolerance is 1 % Span between 0 and 30 % of span; and 0.5 % Span between 30 and 100 %, two tolerance segments are needed. Do not use this feature when the device has a compound tolerance such as %Rdg + %Span. In this case, use the appropriate <Tolerance Type> selection.*
Segment Tolerance (required drop down list selection)	Selects the tolerance formula used to calculate the tolerance for each output. Each tolerance choice defines a specific tolerance determination technique. See Section 4.3.6.2.3.1, Tolerance Choices for a detailed explanation of each tolerance choice. Entries are provided for %Reading, %FS and Constant values as required by the specific tolerance selection.

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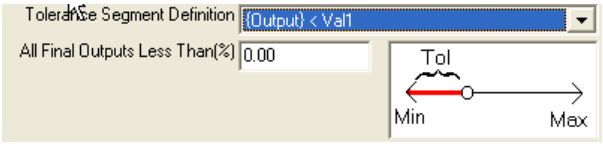
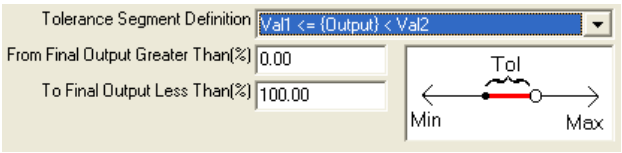
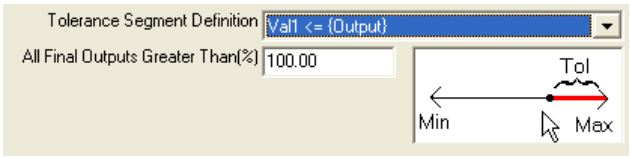
FEATURE	DESCRIPTION
Tolerance Segment Definition (conditional drop down list selection)	The selection defines the portion of the device final output span to which the tolerance information applies. Each selection generates a new graphical representation of the segment. The graph is intended to aid in understanding how the tolerance is applied. The graph is not proportional to the segment size defined. The segment definition choices are: **All Final Outputs** — The tolerance information is valid for the entire span (minimum to maximum) of the device. This selection cannot be used when more than one tolerance segment is specified. **{Output} < Val1** — The tolerance information is valid as long as the measured output is strictly less than the value entered. The value must be entered in terms of percent of the output span.  **Val1 <= {Output} < Val2** — The tolerance information is valid as long as the measured output is greater than or equal to the first value entered and strictly less than the second value entered. The values must be entered in terms of percent of the output span.  **Val1 <= {Output}** — The tolerance information is valid as long as the measured output is greater than or equal to the value entered. The value must be entered in terms of percent of the output span. 

4.3.6.2.3.1 Tolerance Choices

Final output tolerances are specified on **[Tolerance]** tabs of the Output Relationship, the Mass Set and the Piston Cylinder Editors. The tolerance choices are listed below along with plots to detail how the different tolerances are used. Each tolerance selection updates the display of required entries as required by the tolerance type.

In general, use %Span in place of %FS. %Span based tolerances are identical to %FS based tolerances when the minimum final output is 0. Pay careful attention to the difference between %Span and %FS when using differential devices that have no terminal zero point. %FS should normally only be used when the full scale value is equal to the span value or the device tolerance is strictly expressed in terms of full scale.

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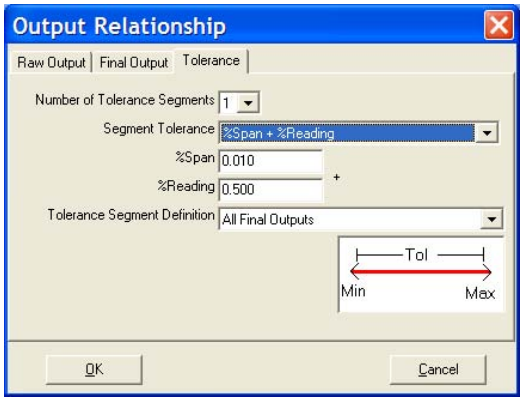
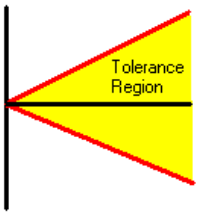


Figure 28. Output Relationship Editor, **[Tolerance]** Tab

Table 17. Tolerance Type Choices

TOLERANCE TYPE	DESCRIPTION
%Reading	The tolerance is calculated as the current reading of the output times the tolerance value. This tolerance is not defined at zero. Never use a %Reading tolerance when the output will reach 0. In this case, use a compound tolerance such as %Span + %Reading.  **Figure 29.** %Reading Tolerance
%Span	The tolerance is a constant value calculated as the final output span times the tolerance value. **Figure 30.** %Span Tolerance
%FS	The tolerance is a constant value calculated as the **<Maximum>** final output times the tolerance value. This tolerance is graphically equivalent to %Span.
Const in Final Unit	The tolerance is a constant value entered in terms of the final output unit of measure. This tolerance is graphically equivalent to %Span.
Const in Raw Unit	The tolerance is a constant value entered in terms of the raw output unit of measure. This tolerance is graphically equivalent to %Span.

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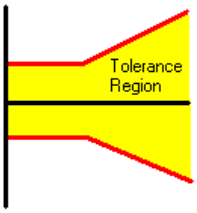
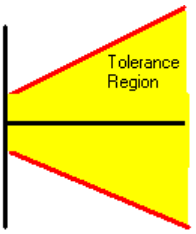
TOLERANCE TYPE	DESCRIPTION
%Span or %Reading (greater of)	The tolerance is calculated at each point as both %Span and %Reading. The tolerance used is the greater of the two.  **Figure 31.** %Span or %Reading (Greater of)
%FS or %Reading (greater of)	The tolerance is calculated at each point as both %FS and %Reading. The tolerance used is the greater of the two. This tolerance is graphically equivalent to %Span or %Reading (greater of).
Const in Final Unit or %Reading (greater of)	The %Reading tolerance is calculated at each point and compared to the const tolerance value. The tolerance used is the greater of the two. This tolerance is graphically equivalent to %Span or %Reading (greater of).
%Span + %Reading	The tolerance is calculated at each point as both %Span and %Reading. The tolerance used is the sum of the two.  **Figure 32.** %Span + %Reading
%FS + %Reading	The tolerance is calculated at each point as both %FS and %Reading. Tolerance used is the sum of the two. This tolerance is graphically equivalent to %Span + %Reading.
Const in Final Unit + %Reading	The %Reading tolerance is calculated at each point and compared to the constant tolerance value. The tolerance used is the greater of the two. This tolerance is graphically equivalent to %Span + %Reading.
Const in Raw Unit + %Reading	The %Reading tolerance is calculated at each point and added to the const tolerance value. This tolerance is graphically equivalent to %Span + %Reading.
No Tolerance Specification	There is no tolerance specification.

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4.3.7 [SET] TAB

The **[Set]** tab is common to the definition editor for all advanced type device setups.

The features on the **[Set]** tab are used to define a device's set capabilities. These include: pressure control, temperature control, valve driver actuation, channel switching (multiplexing), etc. Not all device setups require selections on the **[Set]** tab. Devices that do not provide control or set functions and **DHI** products setup using the **<Auto Detect Setup>** feature do not use the **[Set]** tab.

See 3.3, Device (instrument) Support Concept, to get a thorough understanding of how COMPASS handles devices and final outputs. An understanding of this topic is critical to proper setup of the [Output] tab.

The features on the **[Set]** tab are the same for all device setups. Press the **[Add]** button to create a new final set for the device or press the **[Edit Set]** button to edit an existing final set. Set defining information is entered on the Output Relationship Editor that appears when adding or editing a final set. If necessary press the **[Edit Commands]** button to modify or create remote commands required to send set commands to the device. The fully formatted remote commands must result in a numeric set point value in the **<Set Type>** unit of measure specified on the Set Relationship Editor, **[Raw Set]** tab. The Remote Command Editor, provides features to allow a remote command to be formatted according to the current set point by either using a macro or by substituting the numeric set point for the text "[x]" (see 4.4.3, Control Set Commands).

If necessary press the **[Edit Commands]** button to modify or create remote commands required to send set point information to the device. In addition to Set Commands, **COMPASS** supports the ability to create Ready/Not Ready, Vent and Abort Control commands. This provides complete support of many different types of setting devices or controllers.

Use Initialization Commands as needed to put the device into the state expected by the Set Relationship Editor setup. **COMPASS** assumes that any target output value in the set command must be formatted in the **<Set Type>** unit of measure. Initialization commands can be used to assure the device is configured to interpret set commands in the correct unit of measure. Proper use of initialization commands can guarantee that the setup is valid even after users have accessed the front panel of the device.

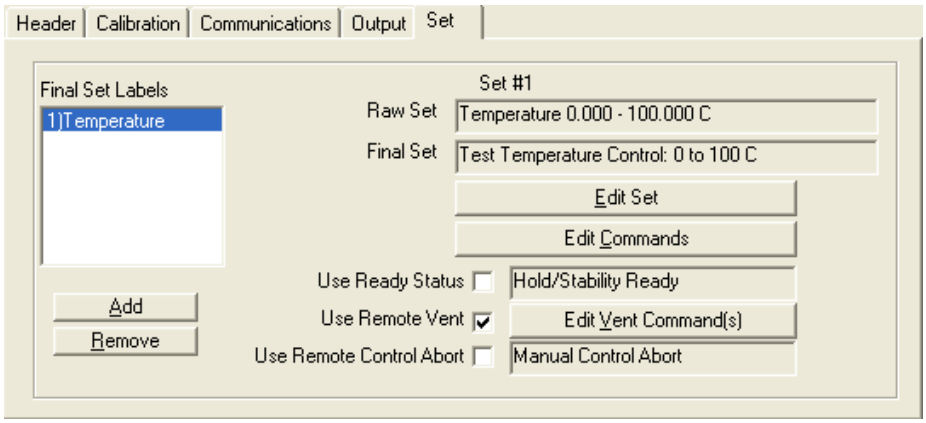

Figure 33. Device Editor, **[Set]** Tab

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Table 18. Device Editor, **[Set]** Tab Fields

FEATURE	DESCRIPTION
Final Set Labels (display list box)	Contains a list of final sets available from a device. Final sets are added and removed using the **[Add]** and **[Remove]** buttons. Select a final set and press **[Edit Set]** to modify a final set's information. This causes the Set Relationship Editor to load. Select **[Edit Commands]** to create or modify remote commands associated with the final set.
Add (button)	Press this button to create a new final set. The Set Relationship Editor displays to allow the final set information to be edited.
Remove (button)	Press this button to remove the final set selected in the **<Final Set Labels>** list. The **[Undo]** button on the **Editor Toolbar** can be used to restore a deleted final set until the record is saved.
Raw Set (label)	Displays raw set information corresponding to the final set label selected in the **<Final Set Labels>** list.
Final Set (label)	Displays final set information corresponding to the set label selected in the **<Final Set Labels>** list.
Edit Set (button)	Press this button to edit the information associated with the final set selected in the **<Final Set Labels>** list. The **Set Relationship Editor** displays. Double-clicking the <Raw Set> or <Final Set> fields is a shortcut to this button.
Edit Commands (button)	Press this button to open the **Remote Command Editor** to edit remote commands specific to the final set selected in the **<Final Set Labels>** list. Only final sets that use a remote interface require remote commands. Commands set up are Set Commands and should be interpreted by the device set point type unit specified in the Output Relationship Editor, **[Raw Set]** tab.
Use Ready Status (optional check box)	Check this box to read the ready/not ready status of a controller by sending remote commands. Many controllers output a specific signal or respond in a particular way when their target output is set within defined limits. This condition is considered *Ready*. If the controller does not provide such an output remotely, do not attempt to use this feature. **COMPASS** has a built in *Ready/Not Ready* criterion that can be setup in a Test Definition (see 3.3.5.3, Ready/Not Ready). When this feature is checked, options in the Test Definition can be used to allow **COMPASS** to read this status after issuing a target output command to the controller. The command is polled on the device and the corresponding ready status displays on the device run screen (see 5.5.4, Device Output Run Screen). This feature is not available for multiplexer and valve driver set types. After each target output, Although Ready commands are setup on the Set tab, they are defined as Read Commands in the Remote Command Editor. The response to a formatted Ready command should yield 0 when the controller is not ready, and a non-zero value when the controller is ready (see 4.4, Remote Command Editor).
Use Remote Vent (optional check box)	Check this box to remotely return a pressure or temperature controlling device to "normal" (ambient) conditions. This feature is available for pressure and temperature controllers only. The commands associated with this feature should return the device to normal conditions. This is typically atmospheric pressure for a pressure controller and ambient temperature for a temperature controller. Checking this feature requires defining remote commands to vent the device if it has a remote interface. In many cases the commands associated with this feature are equivalent to a specific Set Command with the target embedded in the command. Unlike regular Set Commands, **COMPASS** does not merge the defined command with any particular target value. The definition of the normal condition is user defined. When this feature is checked, **COMPASS** can automatically return the system to a normal state upon completion of a test. This is very important for running fully automated unattended tests. Leaving a temperature chamber set to the highest temperature point all night could be avoided by using this feature. When this feature is not checked, **COMPASS** prompts the operator to vent pressure when vent is specified in the Test Definition point sequence.

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FEATURE	DESCRIPTION
Use Remote Control Abort (optional check box)	Check this box to remotely abort pressure control. This feature is available for pressure controllers only. Checking this feature requires defining remote commands to abort pressure control if the device has a remote interface. The commands associated with this feature should abort all active control provided by the device. Abort commands are issued as part of the Leak Test only. When a remote abort option is not provided, the test user must abort pressure control during the leak test when prompted.

4.3.7.1 SET RELATIONSHIP EDITOR

Final sets are created using the features on the Set Relationship Editor. Press the **[Add]** button to create a new final set or press the **[Edit Set]** button to edit an existing final set.

See 3.3, Device (instrument) Support Concept, to get a thorough understanding of how COMPASS handles devices and final outputs. An understanding of this topic is critical to proper use of the Output Relationship Editor.

The purpose of the Set Relationship Editor is to define a setting or controlling device's final sets. There are two types of set targets: physical targets and state targets. Physical targets set a specific pressure or temperature in a test. State targets set multiplexer channels and valve states. Remote commands to control a set point merge a numerical value with remote command text to accomplish sets as required by a Test Definition point sequence. The remote command is merged with the set point by either using a variable substitution method or a macro (see 4.4.3, Control Set Commands). Physical targets also support Ready/Not Ready, Vent, and **Abort** control command setups on the **[Set]** tab of the editor used to define the final set.

For physical targets, the Set Relationship Editor defines how a device's raw set corresponds to its final set. In most cases, the raw set is the same as the final set. This is the case when a device has a remote interface and the remote commands used to control it are in the device's final set unit of measure. In other cases, a support device must be controlled to arrive at a specific final set result. For example, a voltage controlled pressure regulator requires a specific supply voltage to set a target pressure. In this case, the raw set would be voltage and the final set would be pressure. The **<Set Source>** selection must be **<Voltage Supply>**. This tells **COMPASS** that a voltage supplying instrument must be selected to control the regulator during test initialization.

Unlike Output Relationships, Set Relationships do not support macros to convert from the raw set to final set. One of the pre-defined COMPASS relationships must be selected. If the controller cannot accurately set the desired target values, use regulation in the Test Definition to set the target pressure based on a reference output (see 8.6.5, Test Points Sequence, [General] Child Tab).

Raw set to final set manipulation is not supported for state targets such as valve driver actuation and multiplexer channel selection. The remote commands used to communicate with the device require formatting to allow integer targets to set the target channel or valve state. In many cases a Remote Command Macro is required to properly format the target into a remote command. The Remote Command Editor provides features to support the necessary target command manipulation.

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Multiplexer and valve driver remote commands must be formatted to support integer target values to set the desired output.

To define a final set using the Set Relationship Editor, always make selections on the **[Raw Set]** tab first, then the **[Final Set]** tab. Selections on each tab can impact the selections available on other tabs. Making selections in tab order will prevent confusion. The following sections provide detailed information on using the Set Relationship Editor tabs.

4.3.7.1.1 [Raw Set] Tab Setup Procedure

This section describes the features associated with the **[Raw Set]** Tab. A step by step tab completion process is detailed below.

This section describes the features associated with the Set Relationship Editor, **[Raw Set]** tab. A step by step tab completion process is detailed below. **Table 19** provides detailed information on the tab fields and options.

See 3.3, Device (instrument) Support Concept, to get a thorough understanding of how COMPASS handles devices and final outputs. An understanding of this topic is critical for proper use of the Output Relationship Editor.

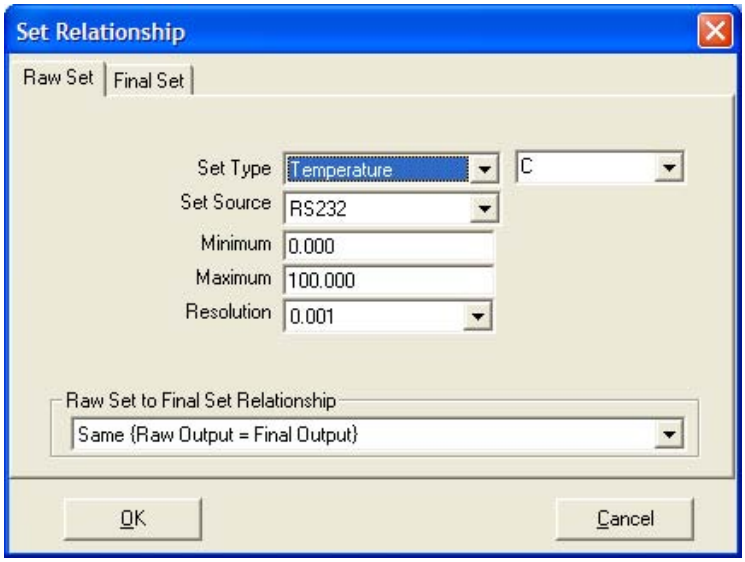

Figure 34. Set Relationship Editor, **[Raw Set]** Tab

❶ Select the **[Raw Set]** tab.

❷ Select the **<Setpoint Type>** and corresponding unit of measure. The **<Setpoint Type>** is a broad classification of sets that determines the available **<Set Sources>**. The selection specifies the **<Raw Set>** as a pressure, temperature, multiplexer, etc. The unit of measure selected is the unit in which the **<Set Source>** interprets set commands. This is the raw setpoint unit.

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❸ Select the **<Set Source>** to specify how **COMPASS** will set the target values. The choices available are the device itself (either manual or its remote interface as specified on the device definition's **[Communication]** tab) or another device selected by its final output set type. When the choice is manual control, **COMPASS** prompts the test user to set a specific output or control state when a test is run.

Device based <Set Source> selections do not require a specific device selection at this step. The actual source device is determined by the Test Definition or is selected during Test Initialization. For example, a voltage controlled pressure regulator would use <Voltage Supply> as the <Set Source> selection. During Test Initialization, the actual voltage supply device is selected. The default devices used throughout COMPASS to supply final sets and outputs are specified using the Default Hardware Configuration (see 12, [Setup], [Default Hardware Configuration].

❹ Enter the **<Minimum>** and **<Maximum>** set values. These determine the raw set span. Depending on the **<Raw Set to Final Set Relationship>**, the values entered may be used to determine the raw set point to apply to a device when given a desired final set value. These fields are disabled for multiplexer and valve driver set point types.

❺ Select the **<Resolution>** to use when displaying and logging the raw set. Use a resolution appropriate for the set device.

❻ Select a **<Raw Set to Final Set Relationship>**. This selection determines how the raw set is manipulated to obtain a final set.

❼ Proceed to the **[Final Set]** tab.

Detailed information on all selections of the **[Raw Set]** Tab are provided in the Set Relationship Editor, **[Raw Set]** Tab Fields Table (see Table 14).

Table 19. Set Relationship Editor, **[Raw Set]** Tab Fields

FEATURE	DESCRIPTION
Set Type (required drop down list selection)	Select the set type of the raw set. This selection describes the general type of the set. Each choice updates the available units of measure and **<Set Source>** selections for the raw set. *State based targets such as <Multiplexer Channel> and <Driver> do not require further selections on any of the Set Relationship Editor tabs.*
Raw Set Unit (required text entry/list selection)	Select or enter the raw set unit of measure. This unit is significant when the **<Set Source>** selection requires a support device. A unit conversion is used to set the output.
Set Source (required list selection)	Select the source of the raw set. The available choices are determined by the **<Set Type>** selection and the settings on the **[Communications]** tab of the device's definition.
Minimum (conditional numeric entry)	Enter the minimum raw setpoint in the specified raw set unit. This field is not available when a state based **<Set Type>** is selected.
Maximum (conditional numeric entry)	Enter the maximum raw setpoint in the specified raw set unit. This field is not available when a state based **<Set Type>** is selected.

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<table>
<tr><th>FEATURE</th><th>DESCRIPTION</th></tr>
<tr><td>Resolution
(required list box selection)</td><td>Set the resolution with which the <Minimum> and <Maximum> setpoint entries display. This selection also determines the default resolution used on the run screens and logged and reported for the raw set.</td></tr>
<tr><td>Raw Set to Final Set Relationship
(required drop down list)</td><td>Select the desired output relationship from the list. The selection determines how COMPASS will manipulate a final setpoint target request into a raw setpoint to set. The choices are listed below.

Unlike outputs, sets are only converted from the final set value to the raw set value. The raw set value is not recorded or used by COMPASS other than to send a remote command to an instrument to achieve the desired set value.

Same - No manipulation is applied to the final setpoint. Use this choice for devices that are directly addressed in their final set unit. Typically, devices that have a remote interface use this selection. When this choice is selected, the [Final Set] tab settings are set to be equivalent to the specified [Raw Set] tab settings.

Linearly Proportional – The final setpoint target is converted to a percentage of its span. This percentage is applied to the raw set span to determine the raw setpoint. The formula used is described below:
$$O_{final} = O_{Span}\left(\frac{F_{Raw} - F_{\min}}{F_{Span}}\right) + O_{\min}$$
<table>
<tr><th>VARIABLE</th><th>DESCRIPTION</th></tr>
<tr><td>O_{Raw}</td><td>Calculated raw setpoint.</td></tr>
<tr><td>O_{min}</td><td>The minimum raw setpoint in the raw setpoint unit.</td></tr>
<tr><td>O_{Span}</td><td>The raw setpoint span in the raw setpoint unit.</td></tr>
<tr><td>F_{final}</td><td>Setpoint target in the <Final Set Unit>.</td></tr>
<tr><td>F_{Spanl}</td><td>Final Setpoint span in the <Final Set Unit>.</td></tr>
<tr><td>F_{min}</td><td>The Minimum Final Setpoint in the <Final Set Unit>.</td></tr>
</table>
Inverse Square – Use this selection when the raw setpoint has an inverse square root relationship to the final setpoint.
$$O_{Raw} = \frac{1}{\sqrt{F_{final}}}$$

Use a Get Command Macro when manipulation beyond the listed choices is required (see 18.5.2, Get Command Macros). Use a relationship of <Same> and perform any related calculations within the macro based on the desired target.</td></tr>
</table>

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Table 20. Raw Set Type and Possible Set Sources

SET TYPE	POSSIBLE SET SOURCES (OTHER THAN THE DEVICE ITSELF)
Current	A device that controls current (Amperes) is required to control the output. The choices are: **Current Control**
Driver	Direct remote commands to the device are required for Driver set types. Intermediary instruments are not supported.
Mux Channel	Direct remote commands to the device are required for Mux Channel set types. Intermediary instruments are not supported.
Pressure	A device that controls pressure is required to control the output. The individual choices confine the list of available pressure measuring controlling devices. During test initialization, the choices are: **Test Pressure Control** — The pressure is controlled by the active test pressure controller **Line Pressure Control** — The pressure is controlled by the active line pressure controller. **General Pressure Control** — The pressure is controlled by any available pressure controller stored in the **COMPASS** database.
Temperature	A device that controls temperature is required to control the device output. The individual choices confine the list of available temperature controllers during test initialization. The choices are: **Test Temperature Control** — The output is controlled by the configured test temperature controller. **General Temperature Control** — The output is controlled by the any temperature controller stored in the **COMPASS** database.
Voltage	A device that controls voltage is required to control the output. The choices are: **Voltage Supply**

4.3.7.1.2 [Final Set] Tab Setup Procedure

This section describes the features associated with the Set Relationship Editor, **[Final Set]** tab. A step by step tab completion process is detailed below. **Table 21** provides detailed information on the tab fields and options.

See 3.3, Device (instrument) Support Concept, to get a thorough understanding of how COMPASS handles devices and final outputs. An understanding of this topic is critical to proper use of the Output Relationship Editor.

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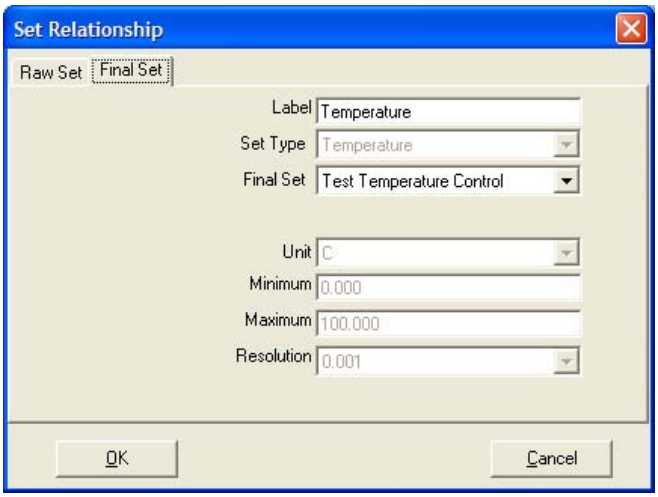

Figure 35. Set Relationship Editor, **[Final Set]** Tab

❶ Select the **[Final Set]** tab.

❷ Enter the **<Final Set Label>**. Features on the **[Tools]**, **[Options]**, **[Initialization]** tab allow final sets to be selected as identified by the value entered in this field (see 14.3, [Initialize Test] Tab). This label may also be used in Test Initialization. In many cases, a useful label is one that is equivalent to the **<Set Type>**.

❸ Select the **<Set Type>**. The **<Set Type>** is a broad classification of sets that determines the available **<Final Set Types>**.

❹ Select the **<Final Set>** to define for what function(s) the set capabilities will be used by **COMPASS**.

The <Final Set> selection ultimately determines for what purposes the device will be available when setting up and running tests.

❺ Select the **<Unit>** in which the final setpoint is defined. **COMPASS** automatically converts to this set unit as required. Pressure sets also require a **<Pressure Measurement Mode>** selection.

❻ Enter the **<Minimum>** and **<Maximum>** final setpoint values. These determine the span and full scale of the final set. **COMPASS** limits any target output to 110% of the **<Maximum>** value entered.

❼ Select the **<Resolution>** to apply to the final setpoint. Use a resolution appropriate for the device.

❽ The final set definition is complete.

Detailed information on all selections are provided in the **Set Relationship Editor**, **[Final Set]** Tab Fields Table (see **Table 21**).

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Table 21. Set Relationship Editor, **[Final Set]** Tab Fields

FEATURE	DESCRIPTION
Final Set Label	A user defined label that describes the final set of the device. This label is how this specific set of this specific device is identified in **COMPASS.** In many cases, a useful label is one that is equivalent to the **<Final Set Type>**.
Set Type (required drop down list selection)	Select the type of the final set. This selection describes the general type of the set. The choice updates the **<Final Set>** choices of units of measure for the final set.
Final Set (required list selection)	Select the final set. The available choices depend on the **<Set Type>** selection. The choice made in this field determines for what tasks this final set will be available for use in setting up and running tests.
Pressure Measurement Mode (required list selection; pressure **<Set Type>** only)	Select the pressure measurement mode of the set. This choice applies only to final sets whose type is pressure. The choices are: **Absolute** **Absolute by ATM** **Gauge**
Unit (required text entry/list selection)	Select or enter the unit of measure in which the final set is defined. **COMPASS** automatically converts this unit to the required test or display unit when running a test.
Minimum (conditional numeric entry)	Enter the minimum final setpoint in the specified final set unit of measure.
Maximum (conditional numeric entry)	Enter the maximum final setpoint in the specified final set unit of measure.
Resolution (required list box selection)	Set the default resolution with which to display and log setpoints.

Table 22. Set Types and Possible Final Sets

OUTPUT TYPE	FINAL OUTPUT CHOICES	
Current	**Current Supply**	The device is used to control current (Amperes).
Driver	**Output Driver Control**	The device is used to control valve driver channels as defined by a Test Definition.
Mux Channel	**Multiplexer Channel**	The device is used as a multiplexer to change channels for data acquisition purposes. The channels are selected during Test Initialization.
Pressure	The device is a pressure controller. If the device is frequently used for different types of pressure control, choose the **<General Pressure>** option.	
	Test Pressure Control	The device is used to control the test pressure when running tests.
	Line Pressure Control	The device is used control line pressure when running tests.
	General Pressure Control	The can be used for any type of pressure control required by a test or another device.
Temperature	**Test Temperature Control**	The device is used to control the test temperature.
Voltage	**Voltage Supply**	The device is used to supply voltage to other controlling instruments.

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4.3.8 [COMMENT] TAB

The **[Comment]** tab is common to the all Device Definition and Test Definition editors in **COMPASS**. This includes DUT, Support Device, Piston Gauge Platform Editors and Test Definitions. The only option on this tab is a 255 character text entry field. Enter text that describes any special setup or notes to associate with a setup. This information is not stored in the data file nor is it available in reports. The comment is intended to allow an operator to quickly determine special setup or use characteristics of a **COMPASS** setup.

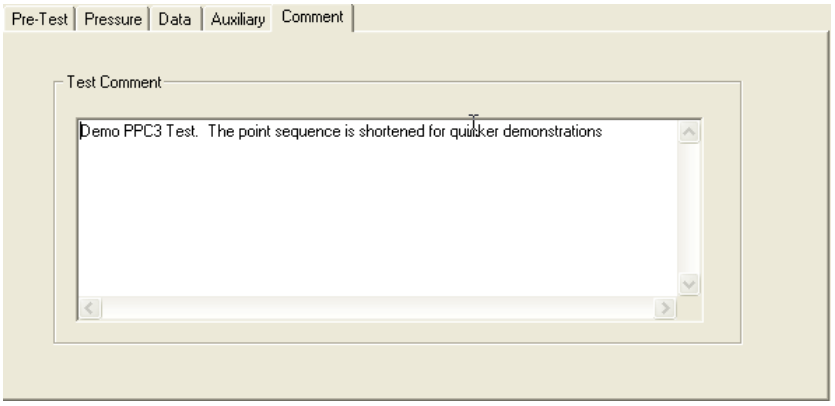

Figure 36. Test Definition Editor, **[Comment]** Tab

4.4 REMOTE COMMAND EDITOR

The remote command editor is used to define commands issued using a remote interface. All **COMPASS** device definitions that use a remote interface, use the Remote Command Editor. A separate command set is required for each unique read (output) and set. Therefore, there are two types of command sets: Read and Set. The key difference is that Read commands are issued continuously and Set commands are only used to set an output. To create a remote command set for a specific device output choose the **[Edit Commands]** option on the appropriate **Device Editor**, **[Output]** or **[Set]** tab and use the following procedure:

❶ Use the Editor Toolbar, **[New]** icon to create a new command or select an existing command from the list of commands.

❷ Select the **<Command Type>** Initialization and Read for measurement based outputs or Set for controlling outputs. It is not necessary to use initialization commands. It depends on the requirements of the device

❸ Specify a **<Command Number>** to define the order in which the command will be issued. **COMPASS** automatically adjusts the numbering order when the command set is saved. It is therefore not necessary to remove gaps in the numbering sequence.

❹ Enter the **<Command>** or select the macro that will be used to create the command. Use the **<Delay After Command(s)>** field if necessary to allow the command to complete a physical process prior to continuing with other commands.

❺ Check the **<Read Response>** option for commands that respond.

❻ If the **<Command>** specifies the command to use for manipulation, check the **<Process Response>** option and select or enter the appropriate **<Manipulate Response>** field. Only one command can have the **<Process Response>** field specified in a command set.

❼ Save the command using the Editor Toolbar, **[Save]** icon.

❽ Repeat the process as necessary for as many commands as are required to control the device.

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Only one remote command can be edited at a time. Save changes to each command before attempting to edit a new command.

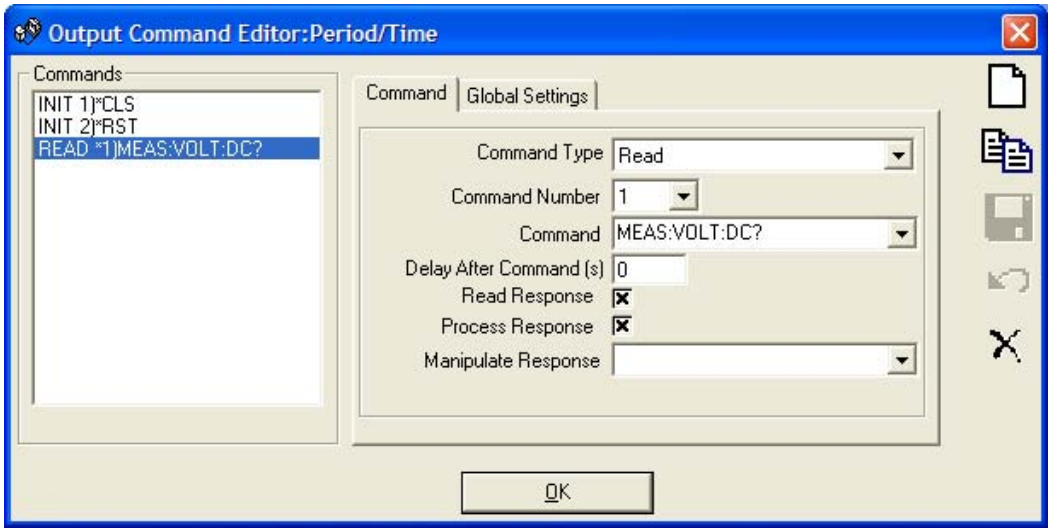

Figure 37. Remote Command Editor

4.4.1 INITIALIZATION COMMANDS

Initialization commands are used to set a remote device to a known state. This can include setting a specific unit of measure, range information, clearing error buffers, etc. All commands entered are sent just one time during the Test Initialization. Responses to initialization commands are not used in any way by **COMPASS**. Macros can be used to create initialization commands based on instrument settings if desired (see 18.5.2, Get Command Macros).

4.4.2 READ OUTPUT COMMANDS

Read commands are used to obtain an output from a remote device. When **COMPASS** is in a run mode that uses the device, the read commands are constantly sent in order to provide real time updating of the device output. The faster the device responds, the faster the refresh rate on the run screens. For this reason, it is best to use the smallest number of commands possible to obtain the desired device response. **COMPASS** however, does not impose a limit on the number of commands that can be used in a command set.

Although, multiple commands can be issued as part of the read process, one command must be specified as the actual read command. This command, when formatted using the **<Manipulate Response>** criterion should yield an output value in the raw output measurement unit specified for the device (see 4.4.4, Editor Options). Refer to the device's Operation and Maintenance Manual for details on remote commands. In many cases the manipulation requires several characters to be ignored before converting the response to a number. In other cases, more significant command manipulation is required, such as BCD (binary coded decimal) or ASCII to text conversions. In these cases, use a **COMPASS Macro** to parse the response using VB Script (see 18.5.6, Reply Parser Macros).

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4.4.2.1 READY COMMANDS

Although ready commands are associated with controlling devices, they most resemble read commands. Ready are continuously issued to an instrument after a target output is set. A ready command must respond with FALSE or 0 when the target output has not been achieved and TRUE (non 0) when the output has been achieved (see 3.3.5.3, Ready/Not Ready). Not all instruments support ready commands.

4.4.3 CONTROL SET COMMANDS

Set commands are used to stimulate an output in the device. The command set should generate an output in the **<Final Output Unit>** of the device. A pressure controller should use these commands to set a pressure in the controller's **<Final Output Unit>**. **COMPASS** automatically handles unit conversion between the required set unit and the current testing and display unit. As with Read command sets, multiple commands can be used, however only the command with **<Process Set>** is combined with the current set point based on the **<Process Set>** selection to create a new command (see 4.4.4, Editor Options).

A set command can be entered directly or created using a **COMPASS** Macro (see 18.5.2, Get Command Macros). Commands available in the drop down list are a result of **COMPASS Macros**. Commands created using a macro do not require the **<Process Set>** selection. The target value provided to the macro function should be used to create the target command.

Set commands typically have a command portion and a target portion. The command portion designates that a specific set point will occur and the target portion is the numerical set point value. The actual command and format are device specific, so refer to the device's manual for command details. Since the target output will change based on test conditions, the required test command must vary to accommodate the new target. The **<Process Set>** selection tells **COMPASS** how to adjust the command for a given set point. The most common choice is **<Replace [x]>**. This tells **COMPASS** to substitute the current numerical set point in the **<Final Output Unit>** with the text "[x]". Commands that require more significant manipulation should use a **COMPASS** Macro to create the command based on the current target.

For example, a PPC3 uses the command "PS=20" to set 20 psi, assuming the PPC3 is already in psi. The command "PS=30" is used to set 30 psi. Substitution of the value after the equals sign with the desired target will yield the command necessary to send to the device. In this case create a command "PS=[x]" in the **<Command>** field and choose the **<Replace [x]>** option as the **<Process Set>** selection.

COMPASS formats all numeric targets to set commands according to the specified <Final Output Unit> and <Resolution>. The range of targets is limited to 10 % of the specified <Min Output> and <Max Output> values.

Enter control targets in the display unit on the <Device Output> run screen to change device targets when running manual tests.

4.4.3.1 ABORT/VENT COMMANDS

Abort and Vent commands are special cases of Set commands. Unlike typical set commands, no target information is merged with the command. Abort commands must abort control in the instrument without manipulation and vent

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commands must return the instrument to ambient conditions without manipulation. Macros can still be used to create the remote commands if desired.

4.4.3.2 MULTIPLEXER/VALVE DRIVER COMMANDS

COMPASS uses positive integer values only when creating multiplexer and valve driver commands. It is up to the user to associate these integer values with more complex connections and states in the actual instrument. For example, a multiplexer channel of 1 may actually require multiple channels on the multiplexer to be set. In many cases, this will require a **COMPASS** Macro.

4.4.4 EDITOR OPTIONS

The tables below describe the options available in the Remote Command Editor. Not all options are available in both Read and Set command sets.

Options on the [Command] tab apply to the selected command in the <Commands> list only and not the entire command set and not just the selected command.

Table 23. Remote Command Editor, **[Command]** Tab Fields

FRAME LABEL	DESCRIPTION
Commands (display list)	List of all commands that are currently in the command set. Selecting a command in the list updates the editor for the current command selected. Only one command can be edited at a time. Use the **[Save]** toolbar option to save command changes.
Command Type (drop down list selection)	Determines the type of command to setup. A device the is used to measure supports: Initialization and Read commands. A device that is used to control supports Initialization and Set commands. **Initialization commands** — Sent one time during test initialization according to the **<Command Number>** value. **Read commands** — Sent continuously so long as the device is active in **COMPASS**. **Set commands** — Sent only when a new target is requested by a Test Definition or via user interaction on the **<Device Output>** run screen (see 5.5.4, Device Output Run Screen).
Command Number (drop down list selection)	The numerical order in which commands are sent. Commands of the same type are sent according to their ascending **<Command Number>** order. All **Initialization** commands are issued followed by all **Read** or **Set** commands, depending on the Output Type.
Command (text entry/drop down list)	Enter the command text to use to send a command or select a macro from the list. The macro must return a string that is the exact command required by the device. Do not include a command terminator for the remote command if a **<Command Terminator>** value is specified in the remote interface setup of the device (see 4.3.5, [Communications] Tab). Set commands are adjusted by the **<Apply Set>** selection when the selected command is not the result of a macro. In the event that the command required to interface with a device cannot be entered using a standard keyboard (requires non printable ASCII characters) or manipulation is required to create a command for the device, use a **COMPASS** Macro to create the command using VB Script (see 18.5.2, Get Command Macros). A mechanism is provided to send specific data bytes to a device. Enter the text "**BYTE:=**" followed by a series a data bytes (0 – 255) separated by spaces. The numeric values are converted to a sequence of characters and sent to the remote device. Make sure that decimal values are entered and not hex (255 not FF). For example, enter the command "BYTE:= 2 27" to send the characters 2 and 27 (Hex 02, 1B). Most devices that require specific byte data in this way do not use command or response terminators.

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FRAME LABEL	DESCRIPTION
Delay After Command (numeric entry)	Enter the length of time to suspend remote interaction with the device after the COMMAND is issued. A delay is typically used to allow a physical process to complete between commands. For example, if a valve takes 3s to physically change states after a command is issued, a 3s command delay should be used to prevent **COMPASS** from carrying out actions associated with a particular valve state change. The delay can also be used to allow an internal device average to complete prior to requesting an output. For example a DMM may use 3 commands to read a specific output: "INIT:VOLTAGE:DC 0.001", "TRIGGER", "FETCH?". The "TRIGGER" command initiates an internal averaging cycle that is setup on the DMM front panel. If the average were 5s, the "FETCH?" command will take 5s to respond. Opposed to polling the IEEE bus for 5s, a delay of 5s after the "TRIGGER" command will allow a more response **COMPASS** remote interface.
Read Response (check box)	Check this box to poll the remote interface until the response of the device is returned. If the device does not respond or the device will continue to function properly when the response is not read, do not check this option. When checked, a response is considered complete when the **<Response Terminator>** character(s) is returned. If a response is not complete within the **<Command Timeout>** interval, the response is considered to have "Timed Out".
Process Response (check box used for Read Command Sets only)	This option is valid for **Read** commands that have the **<Read Response>** option checked. Check this value when a formatted response to this **<Command>** will yield device **<Raw Output>** value in the **<Raw Output Unit>**. This output is manipulated according to the range setup to yield a **<Final Output>**. Only one command in a **Read Command Set** can use this option.
Process Set (check box used for Set Command Sets only)	This option is valid for **Set** commands only. Check this value when the command in edit should be combined with the current target output to form the final command. The **<Apply Set>** option determines how this manipulation is handle when the **<Command>** is not the result of a **COMPASS** Macro. Macro generated commands must include any target requirements in the macro code.
Manipulate Response (text entry/drop down list. Read Command Sets only)	Applies only to commands with **<Process Response>** checked. Text entered is used to allow **COMPASS** to properly interpret the output when the response does not start with the output value. This field can include any combination of delimiters and numerical space values. For example, a device might return the string, "Pressure:4.343 psi". The actual output value for this example appears at position 10. Therefore, 9 leading characters need to be stripped prior to processing the string. Alternatively, if the colon following "Pressure" will always appear prior to the pressure value, ":" could be entered as the leading character to strip. In some cases both a delimiter and a number of characters to strip may be required. For example, if a remote device returns "Range 1, 4.34 volts, NR 4.431 psi", the number of characters in the volts output can change making it impossible to use a fixed length value for the number of spaces to remove to access the pressure value. To avoid this problem enter the text **<,,4>**. This tells **COMPASS** to move to the second comma, then increment four spaces to read the pressure output value. *Only non-numeric text can be used as a delimiter in the leading characters to strip field. All numerical entries are assumed to represent the corresponding numerical value.* Alternatively, a **COMPASS** Macro can be specified to format responses that do not conform to simple text manipulation. All available macros display in the list box. Select the desired macro or create/edit a macro by using the **<[Add Macro]>** menu choice (see 18.5.6, Reply Parser Macros).
Apply Set (drop down list selection Set Command Sets only)	Determines how a set command with the **<Process Set>** option checked will be combined with the current target output to yield the final set command. This option applies only when the **<Command>** is not the result of a **COMPASS** Macro. There are 2 choices: **Automatic** — **COMPASS** takes no special action on the command. The exact value specified in the **<Command>** field is sent to the remote device regardless of the set point. Use this choice with controlling devices that have a pre-programmed sequence of targets that correspond to Test Definition targets in **COMPASS**. The **<Command>** should move to the next step in the pre-programmed sequence of steps. **Replace[x]** — **COMPASS** replaces the text [x] with the numeric target output in the **<Final Set Unit>** of the device. Multiplexer and valve driver state changes use positive integer values for [x] only.

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Options on the [Global Settings] tab apply to the entire command set and not just the selected command.

Table 24. Remote Command Editor, **[Global Settings]** Tab Options

FRAME LABEL	DESCRIPTION
Use Multiplexer (dropdown list)	Determines the association of a remote command set to the state of a multiplexer. This feature is commonly used for DMMs that will be multiplexed to read several DUTs at the same time. The choices are: **Always** — During test initialization, the device must specify a multiplexer to use and corresponding multiplexer channel **Sometimes** — An option to use a multiplexer is provided during test initialization. The selection is not necessary. **Never** — There is no choice to use a multiplexer during test initialization. If a multiplexer is used, **COMPASS** sends the remote commands to activate the desired channel on the multiplexer, then issues the appropriate read command on all devices that use that channel. This process is repeated for all channels specified for use during test initialization.
Poll Frequency (ms) (numeric entry)	Specifies the delay interval between sending consecutive command sets. Typically this value is 0. This allows **COMPASS** to send commands in a loop to the remote device as fast as possible. In some cases this is not desired. Particularly, when an interface is shared. Shared interfaces use the same remote resources. If a faster refresh rate on one output is more desirable relative to another one, increase the delay interval to slow down the less desirable command.

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NOTES

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5. MAIN DISPLAY AND FEATURES

5.1 OVERVIEW

The **COMPASS for Pressure** main screen contains the interface between the program setup and all of the data acquisition run screens. When **COMPASS** is first started, the main screen displays without any child windows. Only after a menu option is selected does the screen update to display the corresponding window. The following features are available on the main screen:

Main menu bar	To access all **COMPASS** menus and functions.
Status bar	At the bottom of the screen that contains information on the status of test execution.
Run mode display	To indicate the current **COMPASS** run mode.
Main toolbar	Provides quick access to runtime program displays and functions.
Several individual run screens	Are available when running to provide real time data acquisition information.

5.2 MAIN MENU BAR

The main menu bar is divided into six separate selections. Each menu item is summarized below and covered in detail in various sections of this manual.

5.2.1 [RUN]

[Run Test]	Initialize and run a Test Definition. Test Definitions are pre-defined test scripts (see 7.2, [Run], [Run Test]).
[Run Manual Test]	Initialize and run a manual test. Manual tests provide monitoring and control features without a pre-defined test script. Manual tests also support data acquisition (see 7.5, [Run], [Run Manual Test]).
[Exit]	Close **COMPASS**.

5.2.2 [SETUP]

All of the necessary program setup features are contained in this menu choice. The ability to create Test Definitions, DUT Definitions, Support Device Definitions, Piston Gauge Definitions and the Default Hardware Configuration are amongst the available choices.

[Test]	Create, edit, view and delete Test Definitions using the Test Editor (see 8, [Setup], [Test]).
[DUT]	Create, edit, view and delete DUT Definitions using the DUT Device Editor (see 9, [Setup], [DUT]).

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[Support Device] Create, edit, view and delete non-DUT devices using the Support Device Editor. Devices defined using this option can also be used as DUTs (see 10, [Setup], [Support Device]).

[Default Hardware Configuration] Specify non-DUT devices to use by default when running a test. Test Definition device selection override the default hardware (see 12, [Setup], [Default Hardware Configuration]).

[Piston Gauge]

[Piston Gauge Platform] Create, edit, view and delete Piston Gauge platforms using the Piston Gauge Platform Editor (see 11.2, [Piston Gauge Platform]).

[Piston-Cylinder] Create, edit, view and delete Piston-Cylinders using the Piston-Cylinder Editor (see 11.3, [Piston-Cylinder]).

[Mass Set] Create, edit, view and delete Mass Sets using the Mass Set Editor (see 11.4, [Mass Set]).

[Mass Bell] Create, edit, view and delete Mass Bells using the Mass Bell Editor (see 11.5, [Mass Bell]).

[Pressure Media] Create, edit, view and delete pressure medium profiles using the Pressure Medium Editor (see 13, [Setup], [Pressure Media]).

5.2.3 [TOOLS]

[Options] Select options to customize **COMPASS** behavior (see 14, [Tools], [Options]).

[Remote Communications] Send and receive remote commands manually using the Direct Remote Communication tool (see 15, [Tools], [Remote Communications]).

[Unit of Measure Converter] Run the Unit of Measure Converter. This tool not only acts as a convenient unit converter, it also provides the ability to create custom pressure units. On-line help is available in the Unit of Measure Converter by accessing the **[Help]** menu within the tool.

[Piston Gauge Calculator] Using the Piston Gauge Calculator feature, Piston Gauge pressure is determined for a specified Piston Gauge platform, Piston-Cylinder, Mass Set and Mass Bell (see 16, [Tools], [Piston Gauge Calculator]).

[PG7000 Setup Extractor] Download Piston-Cylinder, Mass Set and Mass Bell information from a **DHI** PG7000 piston gauge. The extracted information is added to the **COMPASS** database and is available for use. Downloading this information is necessary only if the Piston Gauge Calculator is to be used to solve the pressure equation (see 17, [Tools], [PG7000 Setup Extractor]).

[COMPASS Macro Editor] Create, edit, view and delete **COMPASS** Macros using the **COMPASS** Macro Editor (see 18, [Tools], [COMPASS Macro Editor]).

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5.2.4 [DATA]

[View Data File] View a **COMPASS** Data File using the Data File Viewer (see 19, [Data], [View Data File]). The ASCII text file and a data grid is used to display the information in the Data File.

[Plot Data File] Plot information from **COMPASS** Data Files using the **COMPASS** Plot Tool. The Plot Tool provides features to create custom 2D and 3D plots (see 20, [Data], [Plot Data File]).

[Database Data Viewer] Sort, plot and display test data stored in the **COMPASS** Test Data Database (see 21, [Data], [Database Data Viewer]).

[Write Data File to Database] Add an existing test Data File to the Test Data Database. This is a shortcut to the feature available in the Database Data Viewer (see 21.2, COMPASS Data Viewer).

[Export Data File to MET/CAL®] Add an existing test Data File to the Test Data Database. This is a shortcut to the feature available in the Database Data Viewer (see 22.3, Export to MET/CAL).

[Report Editor] Run the **COMPASS** Report Editor to generate a report from a **COMPASS** test Data File or data stored in the **COMPASS** Test Data Database (see 23, [Data], [Report Editor]).

5.2.5 [DATABASE]

[Setup] Setup options specific to the **COMPASS** database. Including the location and file name of the configuration and Test Data databases (see 24.2, [Database], [Setup]).

[Users] Maintain **COMPASS** users and the rights associated with the users (see 24.3, [Database], [Users]). The features in this option are available only to users with administrator level access.

[Change Current User] Activates the **<User Login>** dialog to login as a different user. This is necessary at times when the current user access restricts features required to complete a specific task (see 24.4, [Database], [Change Current User]).

5.2.6 [WINDOW]

Options to select, tile or cascade active **COMPASS** run screens are provided by this menu choice. Use the Main Toolbar, display icons display run screens that are not already active.

5.2.7 [HELP]

Access on-line help and the **<COMPASS About>** dialog for version information.

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5.3 STATUS BAR

The Status Bar is located at the bottom of the main screen. In all run modes, **COMPASS** flashes information related to the current status of test execution on this display. While running tests, two panels and a progress indicator also display with status information on the current test step and point. The red panel on the left displays the current major test step: setting test temperature, pressure, etc. The blue panel indicates the minor test step: stability test, dwell, taking point, etc.

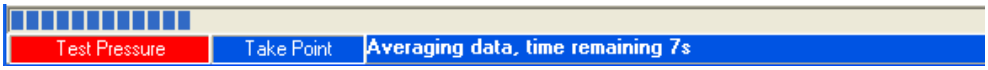

Figure 38. <Status Bar>

Clicking either of the inset panels of the status bar or using the **[Back]** or **[Next]** toolbar options displays the **Test Status** form. This form lists the current test status when running a Test Definition. Including the current point in a test relative to the maximum number of points as well as the status of the leak test if included in the test.

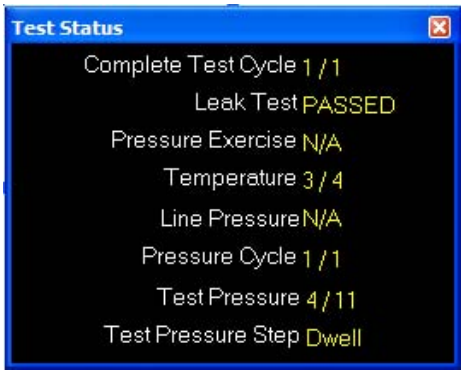

Figure 39. Test Status

The progress indicator is a visual indication of the relationship between the current test point and the number of points in a test. The indicator is a progress bar located across the bottom of the run screen just above the status bar. The left side of the progress bar represents 0 progress and the right side represents 100 %. Each test point increments the progress indicator. When **[Skip Back]** and **[Skip Forward]** buttons are used, the progress indicator also reflects the current position.

5.4 MAIN TOOLBAR

The Main Toolbar in **COMPASS** is used as a shortcut to many menu options and is used to control test execution. The options that are visible and enabled on the toolbar vary with the active run mode. There are four distinct sections of the toolbar. Each of these sections is described in the following tables.

Figure 40. Main Toolbar

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5.4.1 RUN TEST TOOLS

The Run Test Tools section of the Main Toolbar, controls test execution. The icon selections allow tests to begin, end, pause and rapidly move through test steps. Table 20 lists the run tool icons.

Table 25. Main Toolbar, Run Test Tools

ICON	DESCRIPTION
Run Test	This feature is a shortcut to the **[Run]**, **[Run Test]** menu choice. When **COMPASS** is running a test, this option is disabled.
Step Back	Causes the current test point to be interrupted and the test point sequence to step back to the most recent target output step. Subsequent clicks cause the test to step back one point for each click. This tool is used to repeat points when needed. The tool is enabled only in **[Run Test]** mode, as manual tests do not have a defined point sequence to skip through. Step Back does not step back through temperature and line pressure steps, it only allows the setting process to be restarted while it is executing.
Step Forward	Causes the current test point to be interrupted and the test point sequence to step forward to the next step in a point sequence. This feature only moves forward up to the take data step of the highest point executed. The limitation is to ensure that data is logged at each point and points are not skipped entirely. Most often this tool is used to skip through test dwell of an increment or to skip over previously executed points when the step back key has been used. The tool is enabled only in **[Run Test]** mode, as manual tests do not have a defined point sequence to skip through.
Pause	Suspends test execution and remote communications with all devices being used by **COMPASS**. Use this feature to allow front panel access to a device while **COMPASS** is in a run mode. This feature is also useful during test execution as it pauses any test timers currently running. Click **[Pause]** again to resume operation.
Abort	Causes the **<Abort Test>** confirmation pop-up to appear to abort the test that is running.

5.4.2 RUN DISPLAY TOOLS

Run Display Tools provide toolbar features that relate to **COMPASS** run screens. Each of the toolbar icons forces the corresponding run screen to the top of the display. Run display tools are available when **COMPASS** is in a run mode only. Depending on the data acquisition state, not all tools are available even when running.

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Table 26. Main Toolbar, Run Display Tools

ICON	DESCRIPTION
View Test	Causes the Test Definition Editor to display in the main screen with the information corresponding to the active Test Definition (see 8.2, Test Editor). This allows complete information on the current test procedure to be reviewed without interrupting the test. This feature is available only in **[Run Test]** mode. *Do not confuse this option with the [Open Test Editor] toolbar shortcut. It is not possible to edit a Test Definition while COMPASS is running a test.*
Device Run Screen Display	Generates a popup menu to allow the selection of the desired Device Run Screen to display (see 5.5.4, Device Output Run Screen). The selected Device Run Screen automatically displays in the main window. Depending on the selections of the **[Tools]**, **[Options]**, **[Run Test]** tab, the displayed Run Screen may or may not allow direct control of the device (see 14.4, [Run Test] Tab). There are several different run screens. Each **DHI** product has it's own run screen to support it's unique features. Non-**DHI** piston gauges have a run screen that supports entry and selection of the piston gauge conditions used to calculate pressure. All other non-**DHI** devices use a common run screen that lists the device's raw outputs and corresponding final outputs. *Click outputs on the various run screens to get a list of options that apply to the output. Display unit of measure and resolution can be changed for most outputs.*
DUT/Reference Comparison	Display the DUT/Reference Comparison Run Screen. This display provides convenient, real time, error information calculated for each DUT compared to the active reference (see 5.5.2, DUT/Reference Comparison Run screen).
Data Grid	Display the Data Grid with the data logged for the current test. The drop down arrow next to the image allows the selection of data from other DUTs to display when a test is executed with more than one DUT. *The information displayed in the grid and the data logged in the Data File can be modified by using [Tools], [Options], [Data Grid] and [Data in File] (see 14.7and 14.9).*
Data Plot	Display the Plot Tool loaded with data from the current test. No new Data Files can be loaded in the Plot Tool while a test is running. Data from all active Data Files or any one Data File is plotable while running a test. Use the toolbar on the **Plot Tool** to generate the desired plot.
Run Conditions	Displays the Conditions Run Screen. This display lists the current ambient conditions, the active reference outputs and the most recent output target for active controllers.

5.4.3 DATA ACQUISITION TOOLS

In **[Run Manual Test]** run mode, data can be acquired based on the selection of data acquisition tools on the Main Toolbar. The first requirement is to open a Data File by using the **[Create Data File]** function. After the file is selected, the remainder of the data acquisition options are enabled. To log a data point, simply choose the appropriate icon. Points can be taken individually, averaged individually and averaged automatically. When the run mode is ended or a new Data File is created, all of the **[Options]**, **[End Test]** and **[Options]**, **[Data File]** selections are made available.This allows test notes to be entered and empty test files to be deleted (see 14.8 ([Data File] Tab) and 14.5 ([End Test] tab).

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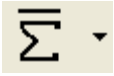
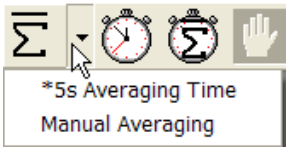
When a Data File is created in [Run Manual Test] mode, data points can be taken without the constraints of a specific test sequence, however, the resulting Data File is identical to files generated with the [Run Test] option. Therefore, reports and plots can be created from the Data File.

Using any of the automatic data logging options can result in very large Data Files. These are files with significantly greater than 1000 data points. COMPASS was not intended to manipulate such files. Lower performance PC's will experience significant delays in generating reports and plots of large Data Files. Therefore, use of the plotting and reporting functions with very large Data Files is not recommended. Instead, export the Data File to a spreadsheet application for further analysis.

Table 22 describes each of the data acquisition toolbar options in detail.

Table 27. <Control> Toolbar, Data Acquisition Options

FEATURE	DESCRIPTION
Create Data File	Press this button to create a new Data File. A standard windows filebox allows the selection of the Data File name and location. The choices in **[Options]**, **[Data File]** determine the default file naming convention and file location. It also specifies whether or not to automatically name the file and avoid the filebox prompt. A separate Data File is created for every active DUT. If there are no DUTs, only one Data File is created. However, no DUT information is logged.
Log a single data point	Logs the instantaneous output of all devices to the Data File. This is identical in function to using a 0 averaging time in a test. All non-automated devices must have their outputs entered in the **<Manual Data Entry >** window.
Average and take 1 point 	Average all devices according to the active averaging method. This is identical to averaging data during a test. Both automatic and manual averages can be used to average the data. The drop down arrow displays a menu that lists the automatic and manual averaging options. The option with an "*" preceding it is the active averaging mode. To change the automatic averaging time select it in the menu and enter the desired averaging time in the input box that follows. Data can be automatically averaged from 1 to 9999s.  **Figure 41.** Manual Averaging Options

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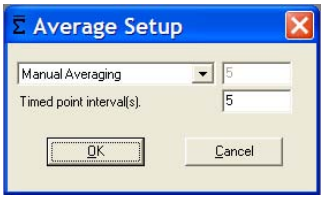
FEATURE	DESCRIPTION
Log 1 point at fixed intervals	Logs an instantaneous data point at fixed time intervals. When the icon is pressed, an input box displays to allow entry of the time interval. **COMPASS** will automatically log a data point when the option is pressed and repeatedly log data points at the specified time interval until the **[Abort Data Acquisition]** button is pressed or the test is aborted. Taking data in this manner can be convenient when trying to monitor slowly evolving processes, e.g. the effect of temperature on a DUT. *The output of all manual entry devices must be entered for every data point logged. This minimizes the automation provided by this function.* *Taking data at short time intervals can quickly result in a very large Data File.*
Average and log points at fixed intervals	Averages all device outputs and logs the results at fixed time intervals. When the icon is pressed the **<Average Setup>** window displays to allow entry of the averaging time and the interval between averages. After the entry, **COMPASS** automatically begins averaging data. When the average is complete, the results are logged and the countdown to the next average begins. When the time specified as the **<Timed Point Interval(s)>** has been reached, another averaging cycle begins. This process is repeated until the **[Abort Data Acquisition]** button is pressed or the run mode is closed. Taking data in this way can be convenient when trying to mimic a test that includes multiple readings per point. *Taking data at short time intervals can quickly result in a very large Data File.* *Press the [Abort Data Acquisition] option to abort fixed interval data acquisition.*  **Figure 42. <Average Setup>**
Abort data acquisition	Press this icon to abort data acquisition at fixed intervals or a point currently being averaged. *Never use other Toolbar features when this icon is enabled. Changing the state of the system while a point is in progress may lead to faulty data logged in the Data File.*

5.5 RUN SCREENS

5.5.1 OVERVIEW

COMPASS uses several different run screen types to display output information while in a run mode. Use the Run Display choices on the Main Toolbar to display a specific run screen. Click and drag the border of a run screen to adjust its size. Closing, minimizing or maximizing any of the run screens has no affect on the run mode. A test continues to run even if all run screens are closed. The **[Window]** menu includes cascade and tile options for common default displays. The combination of these features makes the **COMPASS** user interface totally customizable.

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By default, each run window is displayed in the last used size and position.

Some run screens have toolbars and allow manual input of output information. Others are simple displays of device raw and final outputs. Most numeric outputs support unit and resolution changing as well as strip charting. Access these features by clicking any of the numeric displays.

5.5.2 DUT/REFERENCE COMPARISON RUN SCREEN

This run screen contains a simple display of errors of all DUTs compared to the active reference. The comparison run screen is considered to be the **COMPASS** main run screen. The most common output information is available on this display. The information on the display is organized into rows and columns. The columns separate different pieces of information. The rows separate the different devices. The first row is a label that describes the output. The second row is always the Reference output information. All subsequent rows are for the number of DUTs in use.

Change the unit of measure and resolution of reference and DUT outputs by right-clicking the output and selecting the desired function. Right-click any output and select the [Strip Chart] option to create a strip chart using the selected output.

The triangular indicator next to DUT output is green when the DUT is in tolerance and red when it is out of tolerance. No indicator appears when the DUT does not use a tolerance.

All DHI devices support a "ready" indicator that is green when the device is ready according to the active ready criteria and red otherwise.

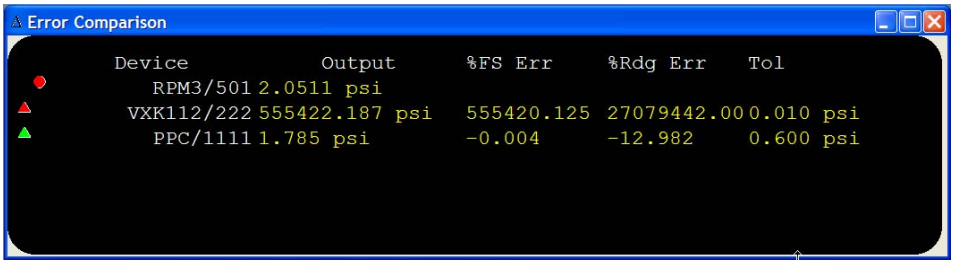

Figure 43. DUT/Reference Comparison Run Screen

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The display features of the DUT/Reference Comparison Run Screen are listed in the table below.

Table 28. DUT/Reference Comparison Run Screen Fields

LABEL	DESCRIPTION
Red or Green Circular Indicator	Use only with **DHI** devices when they are the pressure reference. The circle is green when the output is Ready and red when Not Ready (see 3.3.5.3, Ready/Not Ready). The Ready/Not Ready criteria values are specified in the Test Definition. See the **DHI** product Operation and Maintenance Manual for additional information on the Ready/Not Ready function.
Red or Green Triangular Indicator	DUT in or out of tolerance indication. The triangle is green only when the instantaneous output error is within the tolerance specified in the DUT Definition. Otherwise, the indicator is red. DUTs that do not have a tolerance specified do not display this indicator.
Device	The Model/Serial Number of the configured device.
Output	The output of the device in either the current test unit of measure or the most recently selected display unit. Right-click any output field and select the **[Change Unit]** option to change the displayed pressure unit of measure for all **<Outputs>**. This does not affect the unit of measure that data is logged in. **COMPASS** automatically converts from the device's **<Final Output Unit>** to the selected display unit of measure. There is no need to configure a device to use a specific **<Final Output Unit>**.
Error (%DUTFS)	DUT percent of full scale error. Difference between the DUT and the reference output in %FS of the DUT.
Error (%Rdg)	DUT percent of reading error. Difference between the DUT and the reference in % of reading of the reference
Tol	The +/- DUT Tolerance in the selected display DUT **<Output>** unit.

5.5.3 TEST CONDITIONS RUN SCREEN

The Conditions Run Screen combines all active reference, controller and ambient conditions into a single display. This is a convenient means of checking the state of several devices without having to view multiple run screens.

Change the unit of measure and resolution of an output by clicking the output and selecting the desired function. Click any output and select [Strip Chart] to create a strip chart using the selected output.

Right-click target fields that have a white background to enter a new target. Always enter the target in the target output unit of measure. COMPASS automatically sets the entered target with the test controller. Use this feature when running Manual Tests ([Run Manual Test] mode) to control the state of the test devices (see 7.5, [Run], [Run Manual Test]). When running a Test Definition ([Run Test] mode), this feature can be disabled to prevent users from altering test operation (see 14.4, [Run Test] Tab).

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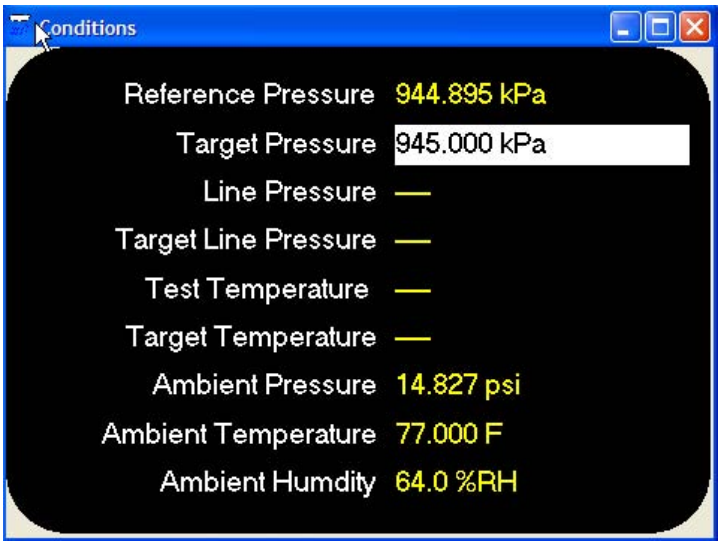

Figure 44. Conditions Run Screen

Table 29. Conditions Run Screen Fields

LABEL	DESCRIPTION
Reference Pressure	The pressure reading of the active pressure reference in the last specified display unit.
Target Pressure	Last requested target pressure sent to the active test pressure controller. This field is updated during tests even when the controller is manual. The Test Definition specified target pressure is used.
Line Pressure	The pressure reading of the active line pressure reference in the last specified line pressure display unit.
Target Line Pressure	Last requested target line pressure sent to the active line pressure controller. This field is updated during tests even when the controller is manual. The test specified line pressure displays.
Test Temperature	The reference temperature of the active temperature reference in the last specified temperature display unit.
Target Temperature	Last requested target temperature sent to the active temperature controller. This field is updated during tests even when the controller is manual. The test specified temperature displays.
Ambient Pressure	The ambient pressure output by the configured ambient pressure device in the **<Ambient Pressure Unit>** or the most recently selected display unit.
Ambient Temperature	The ambient temperature output by the configured ambient temperature device in the **<Ambient Temperature Unit>** or the most recently selected display unit.
Ambient Humidity	The ambient humidity output by the configured ambient humidity device in the **<Ambient Humidity Unit>** or the most recently selected display unit.

5.5.4 DEVICE OUTPUT RUN SCREEN

A Device Output Run Screen is created for each non-**DHI** device that is not a piston gauge. All outputs of a device that are in use have a final output display on one row and all corresponding raw outputs on the next row. The label next to each output is the specified **<Final Output Label>** and the raw output type defined in the output specific setup of the device. A triangular in/out of tolerance indicator is used in the same fashion as on the DUT/Reference Comparison Run Screen (see 5.5.2). An **<H>** displays next to the tolerance indicator when a head correction is applied to the output pressure by **COMPASS**.

Controllers display **<Final Set>** fields with white backgrounds. Right-Click these fields to enter a new target output value. Entering output information into these fields automatically updates the target (setpoint) of the controller. Any associated remote commands are

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automatically issued by **COMPASS** to set the entered target. It is assumed any output entered is in the current display unit of measure. Click these fields to use other controller specific functions such as: regulate, jog, abort control, vent, and set driver state.

Outputs that require manual entry have a white background for the **<Raw Output>** field. Entering a value in these fields automatically updates the **<Final Output>**. It is assumed any output entered is in the current display unit of measure.

Devices that have a remote interface also support the use of Spy Windows (see 5.5.4.1, Spy Windows). These display output specific commands and responses used by **COMPASS** to communicate with a device. Each output has it's own Spy Window. This makes it easy to view the commands used to generate a specific output or response in **COMPASS**. To view a Spy Window, click the **<Final Output>** of any output and select **[Spy Window]** from the popup menu.

Change the unit of measure and resolution of the final output by clicking the output and selecting the desired function. Click any output and select [Strip Chart] to create a strip chart using the selected output.

COMPASS converts the specified final output of a device to the specified display unit of measure. By default, the display unit is the test specified unit or the unit defined in the device setup. It depends on the type of output and the active run mode. In addition, a head correction may be applied to the output (indicated by an <H> next to the tolerance indicator. For this reason, the output displayed in COMPASS will not necessarily match the output displayed on the device.

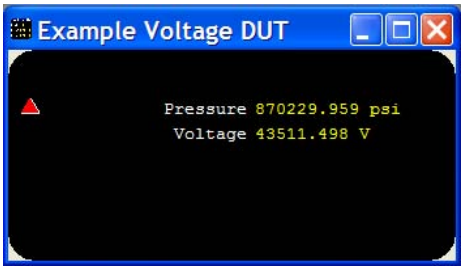

Figure 45. Device Output Run Screen

5.5.4.1 SPY WINDOWS

A Spy Window exists for each device output that requires remote commands. Spy Windows are accessed by right clicking a **<Final Output>** on a Device Output Run Screen and selecting the **[Spy Window]** menu choice. This feature is provided by **COMPASS** to troubleshoot or analyze remote communications. The caption of the Spy Window contains the device name and interface being spied on. Use the information in the **<Command>**, **<Raw Response>**, and **<COMPASS Uses>** fields to determine if **COMPASS** is properly configured for the remote device. The command/response information is updated real time as long as the interface is active and **COMPASS** is not paused.

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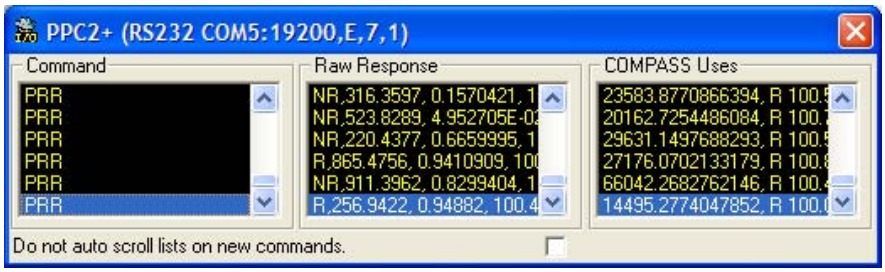

Figure 46. Spy Window Screen

Pay close attention to the device interface in the spy window caption. If the interface displayed does not correspond to the actual device interface, there is a configuration problem in COMPASS or the wrong Spy Window is being viewed. The actual device interface used can be modified during Test Initialization (see 7.3.3, Configure DUT(s)/Devices).

Table 30. Spy Window Information

FRAME LABEL	DESCRIPTION
Command	The exact command sent by **COMPASS** over the device interface. The command terminator is the only portion of the command that is typically not visible. For set commands, make sure the command and set value are properly formatted.
Raw Response	The unmanipulated response to the **<Command>** value issued. This field should always be blank if the command does not have a response.
COMPASS Uses	The **<Manipulate Response>** option setup in the **Remote Command Editor** is used to format the **<Raw Response>** (see 4.4.4, Editor Options). The numeric result is displayed in this field and logged as **COMPASS** data. Responses not specifically used by **COMPASS** do not have a value in this field. When troubleshooting, make sure the value displayed includes the correct device output information.

5.5.5 PISTON GAUGE DEVICE OUTPUT RUN SCREEN

Non-**DHI** Piston Gauges that use piston-cylinder temperature, piston position, piston rotation rate or a vacuum reference require two run screens. The first is very similar to the Device Output Run Screen. The key difference is that the first four rows of information correspond to the configured piston-cylinder temperature, piston position, piston rotation rate, and reference vacuum. All other active Piston Gauge outputs display just as any other remote device output.

The piston gauge information displays on the Piston Gauge Calculator (see 16, [Tools], [Piston Gauge Calculator]). However, several fields of the calculator are disabled. Not only are the Piston Gauge Platform, Piston-Cylinder, Mass Set, Mass Bell and Pressure Medium disabled, but any Piston Gauge condition related field that is measured with a remote device. For example, if the ambient pressure is measured by a barometer configured within **COMPASS** to output remotely, the **<Ambient Pressure>** field is disabled, and the output of the barometer is automatically updated on the field.

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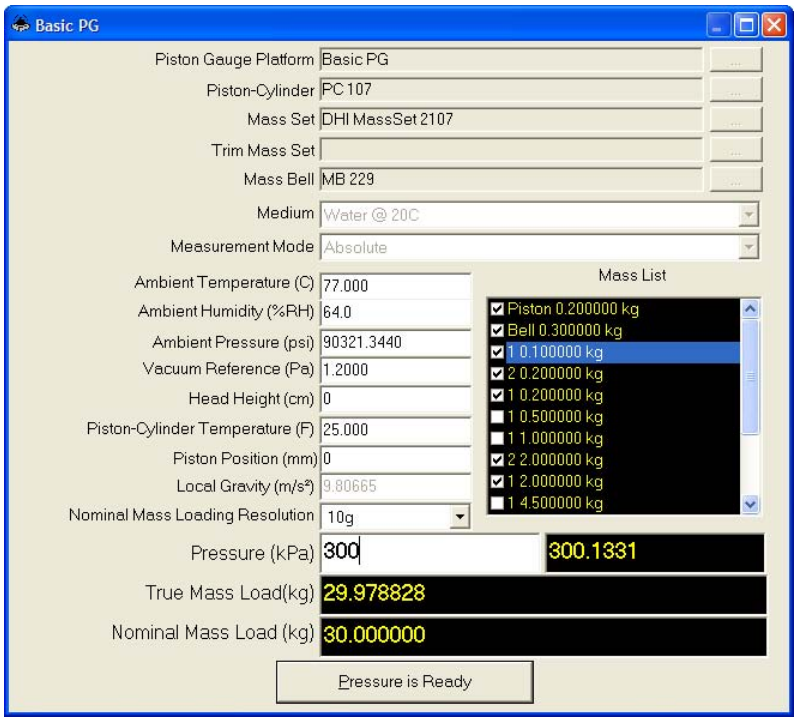

Figure 47. Piston Gauge Run Screen

When running tests that use a Piston Gauge as the pressure reference, the Piston Gauge Run Screen displays with the required mass load selected in the **<Mass List>**. Physically load these masses onto the Piston Gauge and float the piston. When stability is achieved, press the **[Pressure is Ready]** button.

5.5.6 DHI DEVICE RUN SCREENS

DHI products display output information on custom run screens in place of the general device run screens. Each supported device run screen contains tools and output information specific to the supported product. Use the displayed tools as desired to change the state of the device. The following sections describe the **DHI** product specific run screens.

Refer to the device's Operation and Maintenance Manual for complete information on all of its functions and displays.

Click any display value on a run window to get a popup of options associated with the displayed value. Almost any displayed output can also be displayed in a different unit of measure or added to a strip chart.

All run screens display the model and serial number of the corresponding device in the window caption. Use this information to distinguish multiple windows of the same type device.

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Always use the tools on the run screen instead of the device front panel when running tests. Front panel access can interfere with remote communications and with COMPASS program execution. Use the run tools to change pressure and other test parameters as necessary when running a test. If you must use the device front panel while a test is running, use the [Pause] on the main toolbar to suspend test execution and remote communications, allowing access to the front panel controls.

5.5.6.1 PG7000 RUN SCREEN

The PG7000 Run Screen is used for all remotely enabled **DHI** PG7000 piston gauges. This setup requires that a Piston Gauge platform is created when the **<Auto Detect>** setup option checked (see 11.2, [Piston Gauge Platform]). Based on the model and embedded software version of the PG7000, some features may be disabled or not included on the run screen. All relevant piston-cylinder, mass, pressure and ambient conditions information displays real time in the run window. The PG7000 Run Screen also includes a mini-toolbar allowing direct control of certain PG7000 functions. Refer to the PG7000 Operation and Maintenance manual for complete information on PG7000 set up, functions and displays.

Information on each of the PG7000 Run Screen fields is listed in the table below.

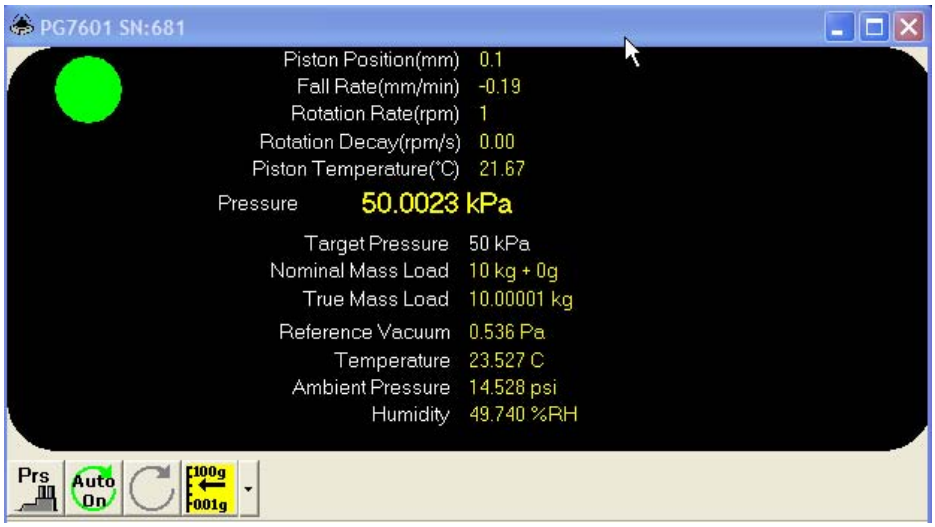

Figure 48. PG7000 Run Screen

Table 31. PG7000 Run Screen Fields

LABEL/ICON	DESCRIPTION
Circular Indicator	Green when the PG7000 pressure is *Ready* and red when the pressure is *Not Ready*. Refer to the PG7000 Operation and Maintenance Manual for details on PG7000 *Ready/Not Ready* conditions.
Piston Position	The piston position relative to mid-stroke [mm].
Fall Rate	The rate at which the piston is moving vertically (fall rate) [mm/min].
Rotation Rate	Piston rotation rate [rpm].
Rotation Decay	Rate at which piston rotation rate is decreasing [rpm/min].
Piston Temperature	The temperature measured by the piston-cylinder platinum resistance thermometer [ºC].

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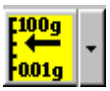
LABEL/ICON	DESCRIPTION
Pressure	The fully compensated PG7000 defined pressure. Right click this field to change the pressure unit of measure. The unit of measure of the PG Terminal display does not change. **COMPASS** performs the unit conversion and displays the resultant value. This value only displays when the PG7000's *Ready* criteria are satisfied.
Target Pressure	The nominal pressure the PG7000 is setting. Enter a value in this field to set a new pressure target. Make sure that the value entered is in the same unit of measure as the pressure display.
Nominal Mass Load	The nominal mass load required to achieve the **<Pressure>** value [kg].
True Mass Load	The total true mass loaded to achieve the **<Pressure>** value [kg].
Vacuum Pressure	The output of the PG7601 or PG7607 vacuum reference sensor [Pa].
Temperature	The ambient temperature measured by the PG7000 [ºC].
Ambient Pressure	The ambient pressure measured by the PG7000 [kPa].
Humidity	The relative humidity measured by the PG7000 [%RH].
Automatic Pressure Generation	Toggles the use of the automatic pressure generation function of the PG7000 when available (see the PG7000 Operation and Maintenance Manual for additional information on this feature). When turned ON, the piston position dead band value must be entered. Target pressures can then be set directly by entering the requested pressure into the **<Target Pressure>** field. The **<Nominal Mass Load>** value displays the required nominal mass to achieve the requested pressure. Automatic pressure generation capability must be set up on the PG7000 prior to running a test. If the function has not been properly set up on the PG7000, no action occurs when this function is selected.
Toggle Auto Rotate	Toggles the state of the optional PG7000 auto rotate feature (see the PG7000 Operation and Maintenance Manual for additional information on this feature). When turned on, the PG7000 auto rotate function operates to rotate the piston at the appropriate time. The displayed icon always represents what will occur if the icon is clicked. Auto rotate should be turned OFF when the mass loading bell is not loaded. If the PG7000 does not have the motorized rotation option, this icon has no effect.
Rotate	Equivalent to the PG7000 terminal's momentary piston rotation key (see the PG7000 Operation and Maintenance Manual for additional information on this feature). Engages motorized rotation when pressed, release when not pressed. This icon has no effect if the PG7000 is not equipped with the motorized rotation option.
Change Mass Loading Resolution 	This function is the equivalent of the **[RES]** key on the PG7000 Terminal (see the PG7000 Operation and Maintenance Manual for additional information on this feature). Use the dropdown menu next to the icon to select the desired mass loading resolution. Then press the icon to set the new resolution value. The mass load for the next requested target pressure will be specified with the selected resolution. Typical mass loading resolution used when calibrating **DHI** RPTs is 0.1 kg (100 g).

5.5.6.2 PPC RUN SCREEN

The PPC Run Screen can be used not only to view the output of a specific **DHI** PPC Pressure Controller/Calibrator model but also to directly control the test pressure. The windows toolbar icons are designed to act as a software interface to the front panel of the PPC. Use the toolbar icons in the same manner the PPC front panel buttons are used. Features are also provided to control the test parameters and change the test target pressure (see **Table 32**).

Hold down the up or down arrow icons by holding down the right mouse key to continuously increase or decrease the pressure. Release the icon to stop the pressure change.

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Figure 49. PPC Run Screen

Table 32. PPC Run Screen Fields

LABEL/ICON	DESCRIPTION
Circular Indicator	Green when the PPC pressure is *Ready* and red when the pressure is *Not Ready*. Refer to the PPCx Operation and Maintenance Manual for complete information on PPC *Ready/Not Ready* conditions
Rate	The current pressure rate of change [pressure unit/s].
Pressure	Instantaneous PPCx pressure. Change the pressure unit of measure by right clicking the display. The unit of measure on the PPCx front panel is not changed. **COMPASS** performs the unit conversion and displays the resultant value.
ATM	Atmospheric pressure output by the PPCx's on-board barometer (if present) [kPa].
Range	The active PPCx range.
Target Pressure	The last set target pressure. Enter a new target pressure and press the computer's **[Enter]** key to set a new pressure with the PPCx.
Hold Limit	The active PPCx control hold limit. Enter a new value and press the computer's **[Enter]** key to change the hold limit.
Stability Setting	The active PPCx stability setting. Enter a new value and press the computer's **[Enter]** key to change the stability setting.
Target Limit	The active PPCx target limit. Only PPC2 and PPCK pressure controllers support this feature. Enter a new value and press the computer's **[Enter]** key to change the target limit.
Toggle Vent	Toggles the state of the PPCx vent function.
Increase Pressure	Increases pressure at the PPCx's fast or slow up rate based on the **<Fast/Slow>** icon. Pressure increases as long as the icon is held down.
Decrease Pressure	Decreases pressure at the PPCx's fast or slow down rate based on the **<Fast/Slow>** icon. Pressure decreases as long as the icon is held down.
Toggle Fast/Slow	Changes pressure increase/decrease rate from fast to slow to determine which PPCx control rate will be used to change pressure when the **[Increase Pressure]** or **[Decrease Pressure]** icon is pressed. No pressure change occurs when this option is selected alone.

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LABEL/ICON	DESCRIPTION
Abort Control	Aborts pressure control if the PPCx is actively controlling.
Valve Driver	Displays the **<Valve Driver Control>** window. Change the state of the PPCx's optional external valve drivers with this function. The current driver state is automatically displayed on the form when it displays.

5.5.7 DATA GRID RUN SCREEN

While in a run mode with at least one Data File open, the **Data Grid Run Screen** is available to display the list of points taken and data associated with each point. Every point up to the current point in the current test cycle is displayed in this grid. The unit of measure for many data types is specified in the corresponding column header. As with the other run screens, the grid display is scalable.

As a test progresses, the current point is automatically highlighted and selected in the grid. Use the options on the **[Tools]**, **[Options]**, **[Data Grid]** tab to prevent the automatic selection of the current test point. When automatic selection is ON, and the grid is scrolled to the top to view points taken earlier in the test, completion of a new point forces the grid back to the last point.

The data types logged and how they are ordered in the grid can be customized (see 14.7, [Data Grid] tab). Any or all of the different data items logged during a test can be displayed at run time in the Data Grid Run Screen. The order of points logged in the Data File is not affected by the grid display. By default, **COMPASS** displays six frequently used columns: **<Reference Pressure>**, **<DUT Output>**, **<DUT Pressure>**, **<%Rdg Error>**, **<%FS Error>**, and **<Status>**. The **[Data]**,**[View Data File]** option and the Data File Viewer always displays all data columns logged to the file in the embedded grid (see 19 and 21.2).

[ ]

Figure 50. Data Grid Run Screen

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5.5.8 DATA PLOT RUN SCREEN

When running a test, the Data Plot Run Screen can be used to display a variety of graphs of the data currently logged in the Data File. The graph can be changed or printed without affecting test execution. Unlike the **[Data], [Plot Data File]** graphing function, no new Data File(s) can be selected (see 20, [Data], [Plot Data File]). However, all other functions supported by the graphing tool are available during tests. Each point taken during a test causes the graph to update with the current test point information. If the **<Force grid selection>** option on the **[Tools]**, **[Options]**, **[Grid]** tab is not selected, the current cycle test data is not automatically displayed on the plot unless that cycle is specifically selected for plotting. For example, if cycle 3 of a 10 cycle test is currently plotted, and the test is executing cycle 7, the results of cycle 7 do not appear in the plot unless cycle 7 is selected using the **[Plot Properties]** toolbar option.

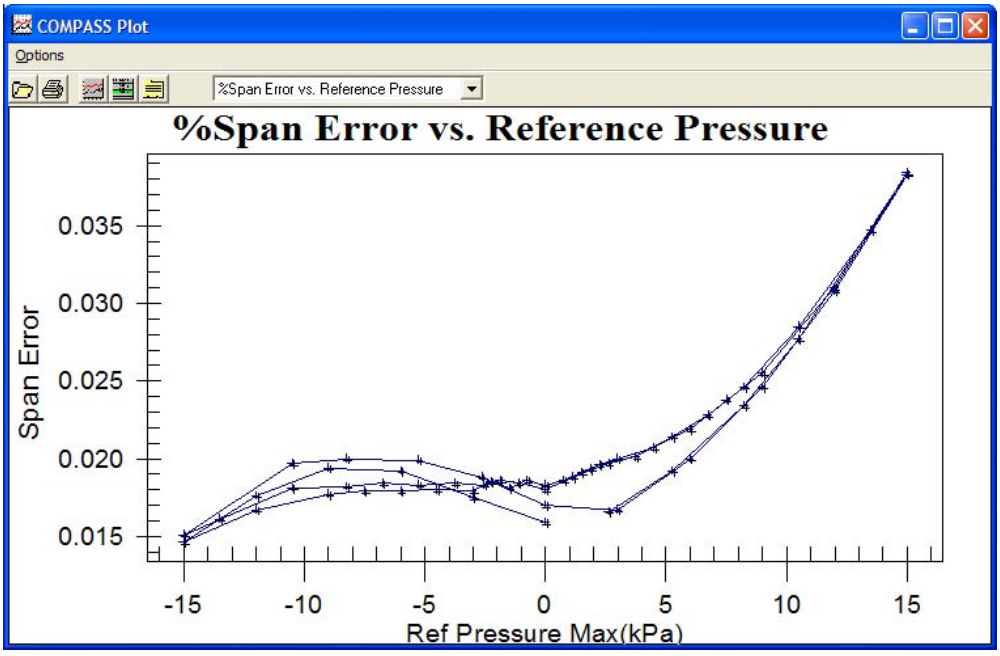

Figure 51. Data Plot Run Screen

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NOTES

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6. How Do I?

6.1 INITIAL SETUP

The following steps and sections should be referred to when setting up and running a test for the first time. As the user of **COMPASS** becomes more familiar, other customization options should be explored to take advantage of the program's extensive capabilities. Several **COMPASS** examples and frequently asked questions are in the Quick Tips section of this manual. These sections are also very useful when learning about **COMPASS**.

Follow the steps below to setup and run a test:

❶ Select **[Setup]**, **[DUT]** to create a DUT Definition (see 9, [Setup], [DUT]). Start with a simple DUT. A DUT that outputs an electrical signal such as V, mV or mA will most likely be read using a digital multimeter. Unless the DUT has a remote interface that provides the electrical output, a DMM must be set up in the Device Definition before it will be available for use.

❷ To use a piston gauge reference or piston gauge DUT select **[Setup]**, **[Piston Gauge], [Piston Gauge Platform]** to create a piston gauge platform (see 11.2, [Piston Gauge Platform]). The other options under **[Piston Gauge]** allow piston-cylinders, mass sets and mass bells to be associated with the platform. Each metrological element requires it's own setup to specify it's unique characteristics. Therefore each piston-cylinder, mass set and mass bell must be created using the Piston-Cylinder Editor, Mass Set Editor and Mass Bell Editor respectively (see 11.3, 11.4 and 11.5).

❸ Select **[Setup]**, **[Support Device]** to update the Device Definition of specific devices, other than DUTs and piston gauges, available for use by **COMPASS** (see 10, [Setup], [Support Device]). These can include reference pressure measuring and controlling devices, data acquisition components, temperature control and other devices. Realize that a single DMM Device Definition can provide voltage, current, frequency and resistance measurement in one setup. When a support device is selected for use, there is no need to access the Device Definition unless a change in the device is necessary.

❹ Select **[Setup]**, **[Test]** to create a Test Definition that describes the test points and other aspects of the testing procedure. The Test Definition also specifies the reference pressure measurement and control devices to use in the test (see 8, [Setup], [Test]).

❺ Select **[Run]**, **[Run Test]** to begin the Test Initialization process required to begin a test (see 7.3, Test Initialization).

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6.2 QUICK TIPS

Set up and run a test?

❶ Create a Test Definition to define the test procedure (see 8, [Setup], [Test]).

❷ Create a DUT Definition to define a device under test (see 9, [Setup], [DUT]).

❸ Configure the hardware to be used to run the test by creating Device Definitions and the Default Hardware Configuration.

❹ Run test.

Run a test in which the pressure at each point is adjusted to a nominal pressure value, for example to the nominal point when calibrating a manual gauge?

Specify **<Jog before dwell>** in the Test Definition. This causes test execution to pause at each point to allow pressure adjustment (jog) prior to taking data at the point (see 3.3.5.2, Jog).

How do I add existing data files to the COMPASS Test Data Database?

There are three ways to add data to the **COMPASS** Test Data Database: Use **[Data]**, **[Add Data File to Database]** menu choice, choose the **[Import Data File]** option in the **COMPASS** Data Viewer (see 21.2), or to add the data automatically at the end of a test by using the **[Database]**, **[Setup]** menu choice (see 24.2).

Test one specific DUT without having to enter its serial number and ID during test initialization?

Set the DUT up as a DUT Definition. DUT Definitions define unique DUTs and include the DUT's serial and ID number. When a DUT definition is run, it is assumed there is only one DUT with the specified serial number and ID. DUT Profiles, allow serial number and range information to be modified during test initialization. DUT Profiles allow a single definition to be used for any number of DUTs of the same type (see 4.3.3, [Header] Tab).

View the current test point during a test?

Click either of the inset panels on the **<Status Bar>** at the bottom of the main display. The Test Status form displays with the current test point information (see 5.3, Status Bar).

Repeat a point in a test?

Use the **[Skip Back]** and **[Skip Forward]** keys from the Run Test Toolbar to move through test points.

Check what Test Definition is being used *while a test is running*?

Click on the Run Test Toolbar, **[View Test]** icon to display the active Test Definition. The test display must be closed before data can be collected during a test.

Repeat the same test several times without having to pause or restart the test?

Specify multiple **<Complete Test Cycles>** in the Test Definition (see 8.7, [Data] Tab). In the **[Data]** tab of the Test Definition specify a number greater than 1 under **<Complete Test Cycles>**. The complete test point sequence will run for the number of times specified without initializing between runs. If all test operation aspects are automated, and **[Tools]**, **[Options]**, **[End Test]**, **<Prompt to repeat last test point>** is NOT checked, the cycles will run without interruption.

Create a custom plot of data logged in the Data File?

There are two ways of going about this. First, **COMPASS** provides the ability to create custom plots within the **[Plot Properties]** toolbar option (see 20.4, Create/Edit Plots). A label for the plot as well as the X and Y data can be setup. The second method requires the use of a third party spreadsheet application, Microsoft™ Excel® for example. Import the delimited **COMPASS** Data File and use plot functions within the tool to create a plot (see 22.2, Export To Excel®).

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Avoid having to go through undesired initialization steps each time a test is started?

Use the **[Finish]** button to automatically complete the test initialization. Selections that are not explicitly defined by a Test Definition or a previous configuration will use a default selection.

Abort a test that is running?

Press the **[Abort]** key on the **Run Test Toolbar**.

Add or remove a pressure test point while editing a Test Definition?

In the Test Definition **<Points>** Table, click the point number or the **[Insert]** button to display a list of point options. Amongst the options are individual **[Insert Point]** and **[Delete Point]** choices. Inserting a point shifts all points down, removing a point moves all points up.

Change the resolution with which the reference and/or DUT readings are displayed while running and recorded in the Data File?

The resolution of any device is determined by its output setup. Edit the device, and select the desired **<Final Output Resolution>**. This is the device's default resolution for displays and the resolution with which data is logged. The display resolution of any output is altered by clicking the output displayed on the run screen (see 5.5.4, Device Output Run Screen). Amongst the items on the pop-up menu is an option to change the output resolution.

Run an automated test with a DUT (or DMM) that uses RS232 if my computer has only one COM port and a DHI device is being used as the reference?

Connect the computer's COM port to COM1 of the **DHI** device. Connect the DUT (or DMM) to COM2 of the **DHI** device. When specifying the DUT's RS232 port select Ref COM2. This tells **COMPASS** to send commands to the DUT by using the pass through capabilities of a **DHI** device. This solution is only possible with **DHI** devices that have a COM2 port.

Troubleshoot communications with remote devices (references, DMMs, DUTs, etc.)?

Use **[Tools]**, **[Remote Communications]** to interface directly with the device, send command strings and display the responses (see 15, [Tools], [Remote Communications]). Be sure to refer to the device's User's Manual for assistance specific to the device. Changes to interface settings made in **[Tools]**, **[Remote Communications]** are temporary. If changes were necessary to establish communications, these changes must be made in the device's Device Definition.

Determine the <Manipulate Response> selection required to get a number from a response to a remote device?

Use **[Tools]**, **[Remote Communications]** to query the device and observe its response string. Count the number of characters that precede the numeric output. This is the number of characters to specify in the **<Manipulate Response>** field.

Log data not already logged by COMPASS?

Use **[Setup]**, **[Support Device]** to create a device to provide the desired output if the output is not already part of an existing Device Definition. When initializing the test, select the desired output in the **<Auxiliary Output>** test step. Realize that any output can be used as an auxiliary device.

Log data without running a test or take data over an extended period of time?

Use **[Run], [Run Manual Test]** to begin data acquisition with the desired devices (see 7.5, [Run], [Run Manual Test]). Select the **[Create Data File]** option on the Run Toolbar. Then use the data acquisition options to log discrete data points or take points over time.

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Copy a COMPASS setup from one PC to another PC or share COMPASS on a network?

To share a **COMPASS** setup, copy the **COMPASS** database files to the new PC or network location, then copy the **COMPASS** options to the second PC (see 2.5, **Network/Shared Installations**). The options can be transferred by creating a *.reg file or by manually selecting the options on the second PC.

Customize the test report created by COMPASS to my own requirements?

Modify the report template to reflect your requirements. It is best to select an existing template, and use the **<Save As>** option to create a copy of the template under a different name. Then edit the template as required to get the desired report output. Drag and drop the insertable fields onto the report template.

Import COMPASS Data Files into MS Excel?

Details on how to import data files into MS Excel are explained in section 22.2, Export To Excel®.

6.3 APPLICATION EXAMPLES

6.3.1 OVERVIEW

This section contains several generic application examples that cover many common **COMPASS** setups. Using these examples and the **How Do I?** section will greatly simplify the learning process. Although each example may not include explicit instructions on all test steps, there are three required steps that must always be followed before any test can be run:

❶ Create (or select) a DUT Definition.

❷ Create (or select) support devices for the DUT (if necessary). This includes the pressure reference.

❸ Create (or select) the Test Definition.

Each of the following examples includes a brief description of the setup steps. Realize that remote commands are specific to each device. When using devices other than those used in these examples, refer to the actual device documentation so that the proper commands are used.

6.3.2 EXAMPLE #1 (DMM)

How do I setup my HP34401A DMM to measure voltage, current and resistance in COMPASS?

The HP34401A is a popular high accuracy Hewlett Packard (Agilent) multimeter that has IEEE-488 and RS232 interfaces. This instrument supports almost all electrical output measurement types: voltage, current, resistance, frequency and period. This is perfect example of an instrument that should be setup with multiple outputs.

- Open the Support Device Editor and press the **[New]** toolbar option to create a new support device.
- Enter information on the **[Header]** tab appropriate for the DMM (see 4.3.3, [Header] Tab).
- Enter information on the **[Calibration]** tab to track the calibration history of the DMM (see 4.3.4, [Calibration] Tab).

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- Select the remote interface that **COMPASS** will use to communicate with the DMM on the **[Communications]** tab (see 4.3.5, [Communications] Tab). In this example, select IEEE-488. This requires the HP34401a to be setup in IEEE mode with a known address. Enter this address on the tab in the appropriate field.

- Select the **[Output]** tab and press **[Add]** to create a new output (see 4.3.6, [Output] Tab).

- The first output will be Voltage. Setup the **[Raw Output]** tab of the Output Relationship Editor as detailed in **Figure 52**. Note that the **<Output Source>** is **<IEEE-488>**. Therefore remote commands must be specified to read the output value. The **<Minimum>** and **<Maximum>** voltages entered do not impact the setup because the selected **<Output Relationship>** is **<Same>**. This means that the value read from the remote interface is the final output. No further manipulation is required.

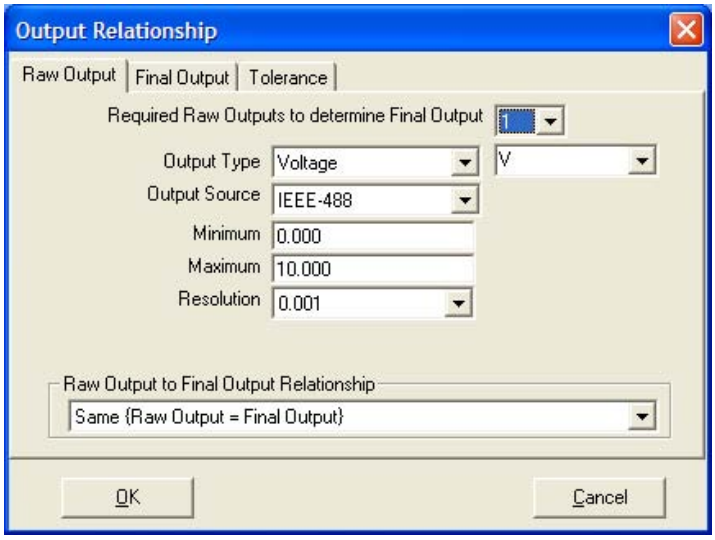

Figure 52. Example Voltage Raw Output Setup

- Select the **[Final Output]** tab and enter information as described in **Figure 53**. The **<Final Output>** selection of **<Voltage Measurement>** tells **COMPASS** that the DMM can be used to measure voltage. During Test Initialization, this output can be selected to read any instrument that has a **<Raw Output Source>** of **<Voltage Measurement>**.

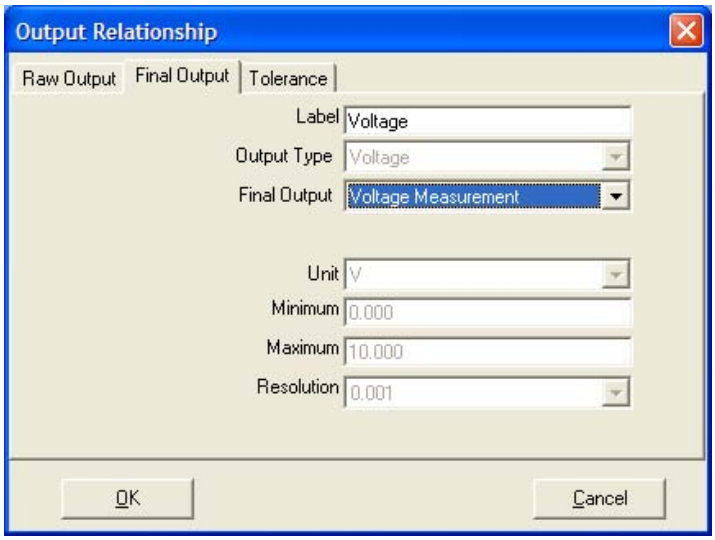

Figure 53. Example Voltage Final Output Setup

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- The entries on the **[Tolerance]** tab are available to associate a tolerance with the voltage output. If desired, choose the **[Tolerance]** tab and enter tolerance settings that correspond to the output voltage of the DMM. Press **[OK]** when all entries are complete. Program control will return to the **Support Device Editor**.

- Since the **<Raw Output Source>** was **<IEEE-488>**, remote commands must be specified to read the instrument. Press the **[Edit Commands]** button on the **[Output]** tab to display the Remote Command Editor (see 4.4, Remote Command Editor). A variety of commands can be used to read the voltage from this DMM. In this example the command "MEAS:VOLT:DC?" will be used to read the voltage and "*CLS" will be used to initialize the instrument.

- Add commands by first pressing the **[New]** toolbar option in the Remote Command Editor to create a new command. Select **<Initialize>** as the **<Command Type>** and enter "*CLS" as the command. This command does not respond so do not check the **<Read Response>** option. Default settings in all other fields are valid in this example. Press the **[Save]** toolbar option to save the command, and then press the **[New]** toolbar option to create a second command. Select **<Read>** as the **<Command Type>** and enter "MEAS:VOLT:DC?" as the command. Check both the **<Read Response>** and **<Process Response>** fields. **<Read Response>** must be checked to tell **COMPASS** to read the output. **<Process Response>** must be checked to tell **COMPASS** that the output of the active command must be manipulated to obtain the raw output of the device. A **<Manipulate Response>** entry is not required because the voltage command directly outputs a numeric value. The Remote Command Editor should look like **Figure 54** when complete. Press **[OK]** to return to the Support Device Editor.

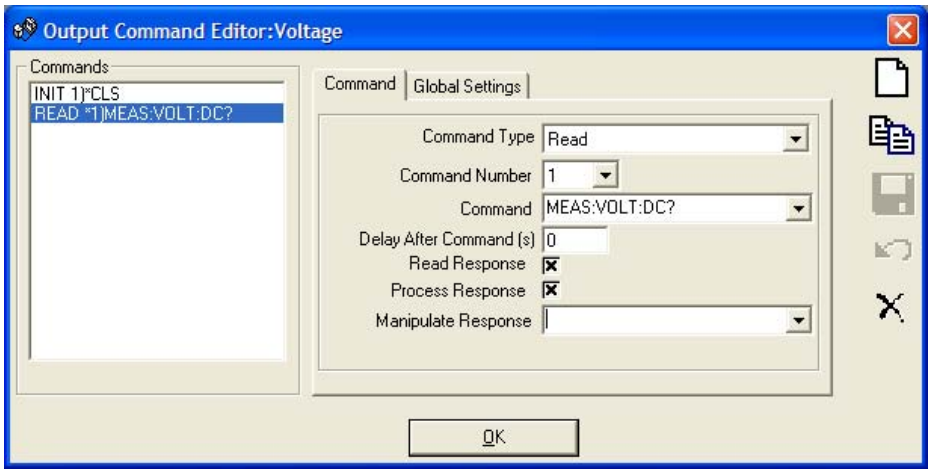

Figure 54. Example DMM Remote Command Setup

- At this point, only the voltage output of the DMM is setup. Repeat the steps described above for each output of the DMM: Press **[Add]**, enter raw output and final output information, and edit the remote commands. When all outputs are properly configured the **[Output]** tab will look like **Figure 55**.

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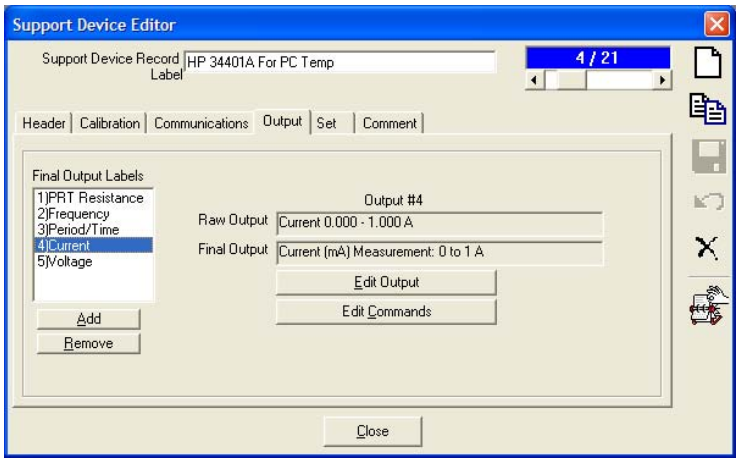

Figure 55. Example DMM Output Tab

- There are no required selections on the **[Set]** or **[Comment]** tabs for this device. Press the **[Save]** toolbar option to store the settings in the database.

- The DMM is completely setup. During Test Initialization, a DMM output will be available for use with any device that has a raw output source that corresponds to any final output of the DMM. For example a voltage output pressure transducer could select this DMM as the actual voltage source device during test initialization.

6.3.3 EXAMPLE #2 (DMM, VOLTAGE OUTPUT DUT)

How do I use my HP34401A DMM setup in example 1 to measure the output of my DUT? The DUT outputs 0 to 5 V corresponding to 0 to 100 psi.

Assume the DMM setup in Example #1 is complete. The task is to setup a DUT with the appropriate output source so that the DMM can be used with the DUT.

- Open the **DUT Editor** and press the **[New]** toolbar option to create a new DUT.

- Enter information on the **[Header]** tab appropriate for the DUT (see 4.3.3, [Header] Tab). Select **<Simple DUT>** as the DUT Type.

- Enter information on the **[Calibration]** tab to track the calibration history of the DUT (see 4.3.4, [Calibration] Tab).

- Select the remote interface that **COMPASS** will use to communicate with the DUT on the **[Communications]** tab (see 4.3.5, [Communications] Tab). In this case the DUT outputs a voltage that is read by another instrument. Select **<Support Device>** as the **<Data Acquisition Type>** type. There are no other communications settings required on this tab.

- Because this is a simple DUT, the output tab includes settings for only 1 output (see **Figure 56**). Enter the given DUT output information. It is important to specify the proper units of measure and **<Minimum>** and **<Maximum>** output values. It is important to select **<Voltage Measurement>** as the **<Source>** on the **<Raw Output>** frame. The selection of <**Voltage Measurement>**, tells **COMPASS** that a voltage measuring device must be selected by the user during Test Initialization (see 7.3.3, Configure DUT(s)/Devices).

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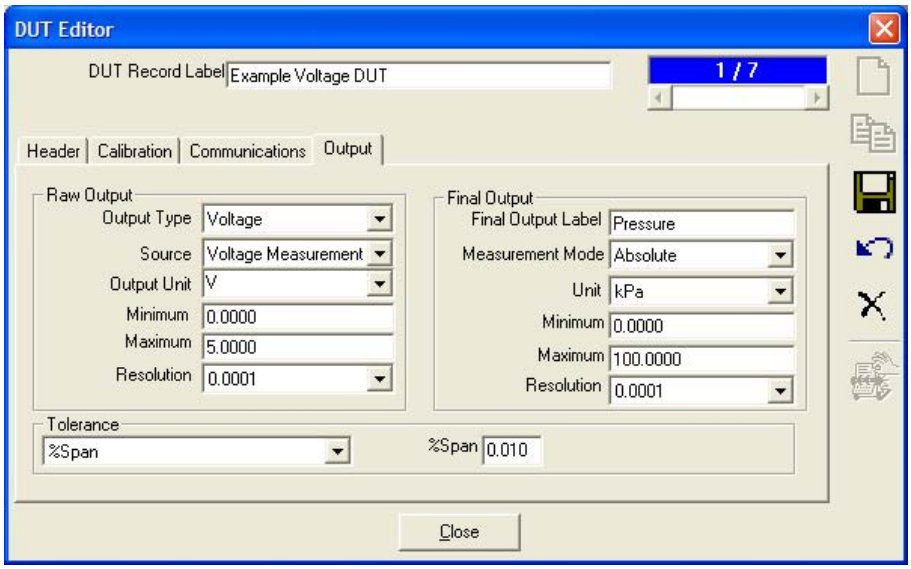

Figure 56. Example Voltage DUT Setup

- Save the DUT by pressing the **[Save]** toolbar option.

- Execute a Manual Test to use the DUT with the DMM by selecting the **[Run]**,**[Run Manual Test]** menu choice. The Run Test Setup form displays to begin the Test Initialization process. Select the DUT from the list of available DUTs and press **[Next]**. The DUT configuration options include a selection for the voltage measuring device. Select the DMM created in example 1 and press **[Finish]**. If all remote interface and electrical connections are correct and secure, the DUT pressure will display on the **DUT/Reference Comparison Display** (see 5.5.2, DUT/Reference Comparison Run screen). **COMPASS** will read the DMM output using the DMM's remote interface and convert the measured voltage into a pressure assuming 0 to 5V corresponds to 0 to 100 psi.

6.3.4 EXAMPLE #3 (PPC3)

How do I setup my PPC3 for use as a pressure reference and a controller?

Any DH Instruments product that is setup with the **<Autodetect Setup>** option checked is available in all setups relevant to the device (see 4.3.3, [Header] Tab). When a DH product is setup in the DUT Editor, the device is available for DUT pressure and control when applicable. When setup in the Support Device Editor, the device is available for reference pressure and control when applicable. If the **<Device can be used as a DUT>** option is selected in the Support Device Editor, the device can also be used as a DUT.

The steps described below should be used to setup the PPC3 for this example.

- Open the Support Device Editor and press the **[New]** toolbar option to create a new device.

- Enter information on the **[Header]** tab appropriate for the header information. Enter "DH Instruments" as the manufacturer and "PPC3" as the model.

- Only when supported manufacturer and model information is entered will the **<Autodetect Setup>** option appear. Check this box when it displays (see **Figure 57**).

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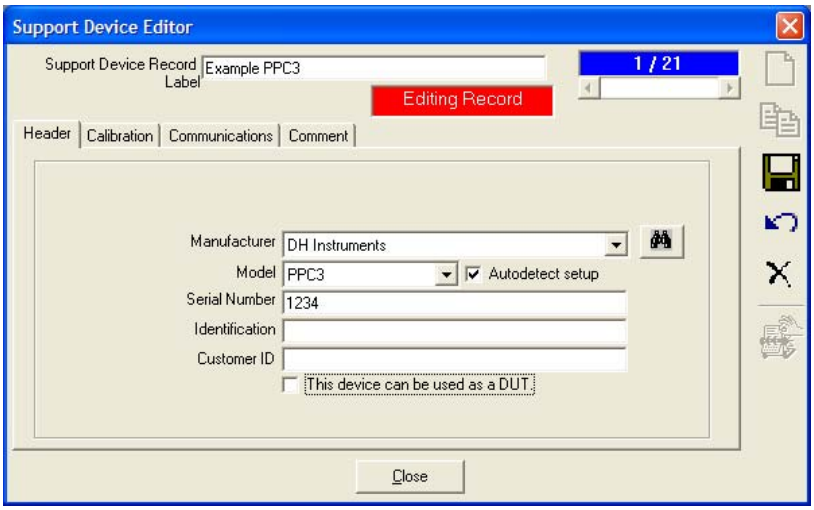

Figure 57. Example PPC3 Setup

- Enter information on the **[Calibration]** tab to track the calibration history of the PPC3 (see 4.3.4, [Calibration] Tab).

- Select the remote interface that **COMPASS** will use to communicate with the PPC3 on the **[Communications]** tab (see 4.3.5, [Communications] Tab). In this case assume the PPC3 will use an IEEE-488 interface. By default all **DHI** products use address 10 unless specifically changed. Enter 10 as the IEEE-488 address. The actual address used and the interface type can be changed during test initialization (see 7.3.3, Configure DUT(s)/Devices).

- Press the **[Save]** toolbar option. The PPC3 setup is complete.

- To verify the setup run a manual test and select the PPC3 as the reference and controller. Choose the **[Run]**,**[Run Manual Test]** menu choice to start a manual test (see 7.5, [Run], [Run Manual Test]). Do not select a DUT at this time. The goal of this run is to simply verify that the PPC3 is properly setup. Press **[Next]** to proceed to the next Test Initialization step (see 7.3.5, Verify/Select Test Hardware). Select the PPC3 in the **<Reference Pressure>** field. It is automatically selected in the **<Pressure Control>** field.

Devices are selected by their <Record Label> and <Serial Number> by default. Change how devices are selected by changing test initialization options (see 14.3, [Initialize Test] Tab).

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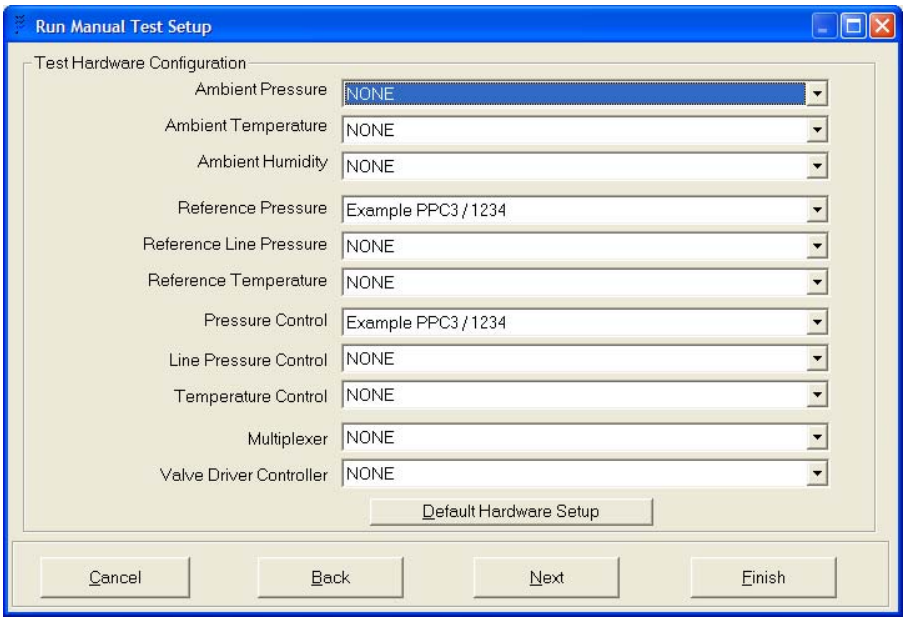

Figure 58. Example PPC3 Hardware Selection

- Press **[Next]** until the PPC3 setup screen displays. Press **[Next]** again or the **[Load Settings]** button to load the range information of the PPC3 (see 7.3.3.2, Configure DHI Device). The available range information will display on the inset panel (see **Figure 59**). Choose the measurement mode and range to use. To use the Auto Range feature of the PPC3, select **<Auto Range>** as the PPC3 range. The **<Max>** and **<Min>** pressure values will be used to Auto Range the PPC3.

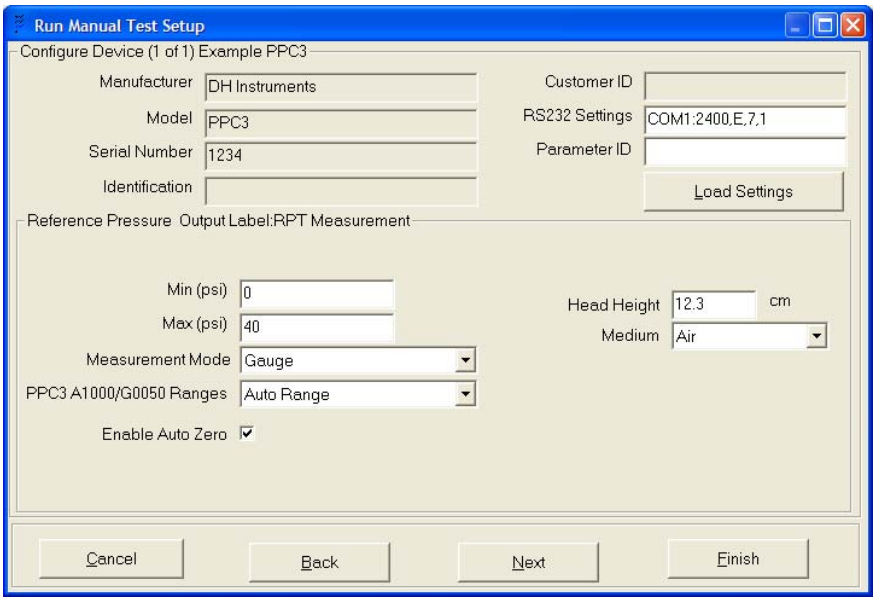

Figure 59. Example PPC3 Device Configuration

- Press **[Finish]** to complete the initialization process and begin polling the PPC3. Use the features on the toolbar to display the PPC3 Run Screen (see sections 5.4.2 (Run Display Tools) and 5.5.6.2 (PPC Run screen)). View and change PPC pressure by accessing the tools on the run screen (see **Figure 60**).

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Figure 60. Example PPC3 Run Screen

6.3.5 EXAMPLE #4 (PG7000)

How do I setup my PG7000 for use as a pressure reference?

Use the **Piston Gauge Platform Editor** to create a new device. Like any other DH Instruments product, select the **<Autodetect Setup>** option to avoid specifically defining all options available on the PG. When **<Autodetect Setup>** is checked, the piston cylinders, mass sets, and mass bells setup on the PG7000 terminal are available for selection during Test Initialization. The final calculated pressure is read directly from the PG7000 by using remote commands.

- Open the **Piston Gauge Platform Editor** and press the **[New]** toolbar option to create a new device.

- Enter information on the **[Header]** tab appropriate for the header information. Enter "DH Instruments" as the manufacturer and the specific PG model, "PG7601", "PG7302" ect.

- Only when supported manufacturer and model information is entered will the **<Autodetect Setup>** option appear. Check this box when it displays (see **Figure 61**).

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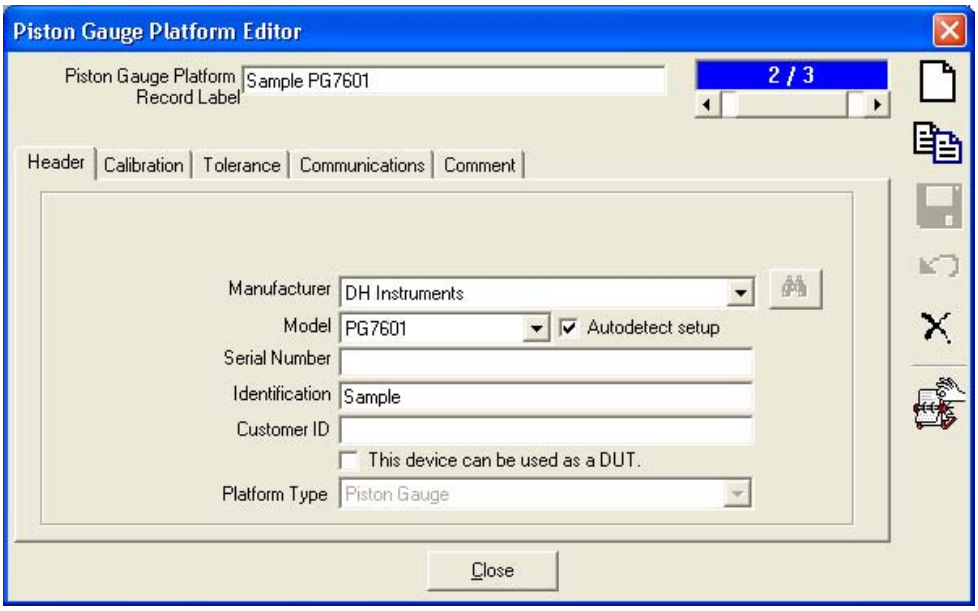

Figure 61. Example PG7601 Setup

- Enter information on the **[Calibration]** tab to track the calibration history of the PG when appropriate (see 4.3.4, [Calibration] Tab).

- Select the remote interface that **COMPASS** will use to communicate with the PG on the **[Communications]** tab (see 4.3.5, [Communications] Tab). In this case assume the PG will use an RS232. By default all **DHI** products use 2400 baud rate, even parity, 7 data bits and 1 stop bit unless specifically changed. Enter these settings and the proper RS232 port used by the PC by pressing the **[Port]** button. The actual port and settings used and the interface type can be changed during test initialization (see 7.3.3, Configure DUT(s)/Devices).

- Press the **[Save]** toolbar option. The PG7000 setup is complete.

- To verify the setup run a manual test and select the PG700 as the reference. Choose the **[Run]**,**[Run Manual Test]** menu choice to start a manual test (see 7.5, [Run], [Run Manual Test]). Do not select a DUT at this time. The goal of this run is to simply verify that the PG7000 is properly setup. Press **[Next]** to proceed to the next Test Initialization step (see 7.3.5, Verify/Select Test Hardware). Select the PG7000 in the **<Reference Pressure>** field. By default the **<Pressure Control>** field will change to **<Manual Control>**. Based on the current preferences in **[Tools]**,**[Options]**,**[Initialize Test]**, the ambient conditions outputs of the PG7000 are automatically selected as outputs.

Devices are selected by their <Record Label> and <Serial Number> by default. Change how devices are selected by changing test initialization options (see 14.3, [Initialize Test] Tab). The selection in Figure 62 is baed on <Record Label> and <Output Label>

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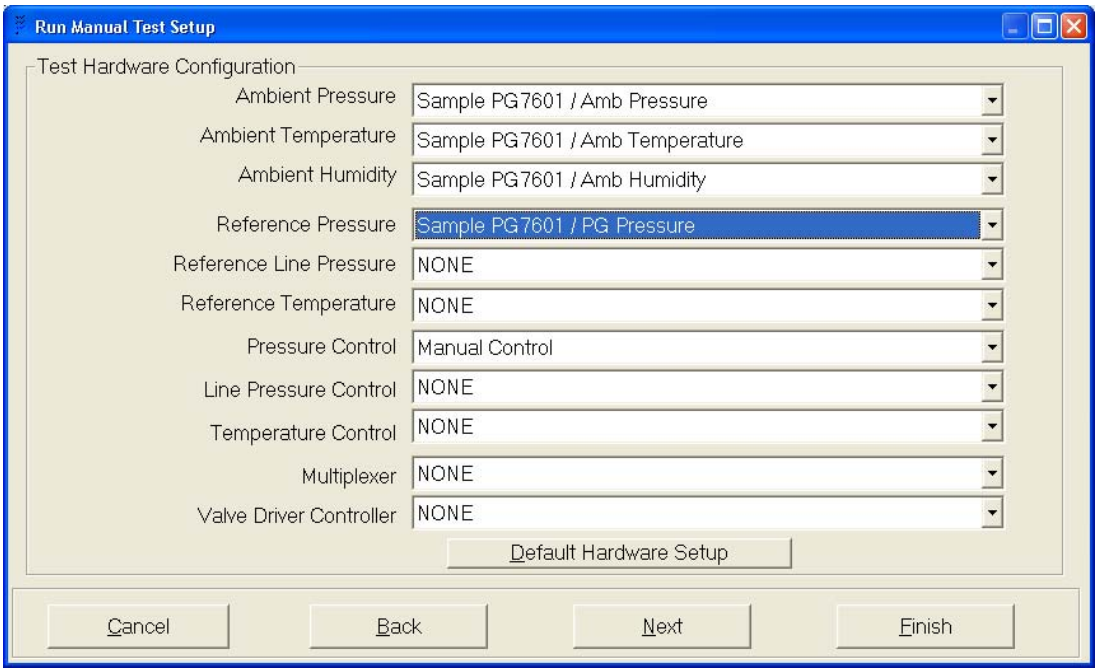

Figure 62. Example PG7000 Hardware Selection

- Press **[Next]** until the PG7000 setup screen displays. Press **[Next]** again or the **[Load Settings]** button to load the piston cylinder, mass set and mass bell information of the PG7000 (see 7.3.3.2, Configure DHI Device). The available range based on the current metrological elements selected displays in the **<Nominal Range>** field on the bottom left of the display (see **Figure 63**). Choose the measurement mode, piston cylinder, mass set and mass bell to use.

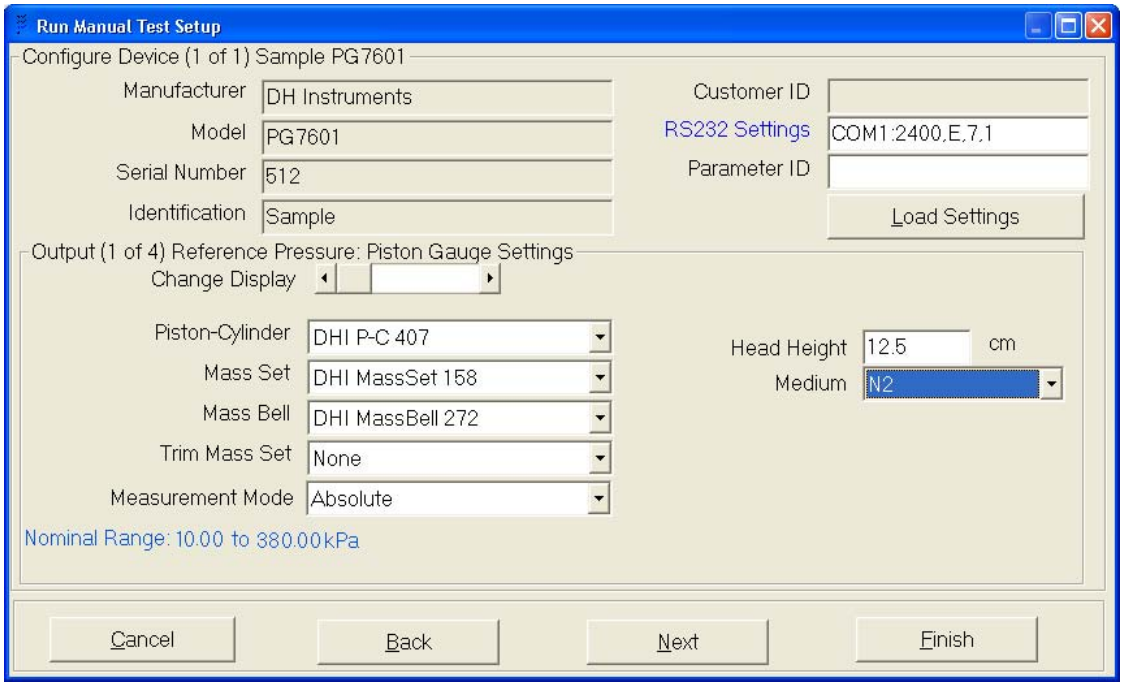

Figure 63. Example PG7000 Device Configuration

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- Press **[Finish]** to complete the initialization process and begin polling the PG7000. Use the features on the toolbar to display the PG7000 Run Screen (see sections 5.4.2 (Run Display Tools) and 5.5.6.1 (PG7000 Run screen). View and change the PG pressure by accessing the tools on the run screen (see **Figure 64**).

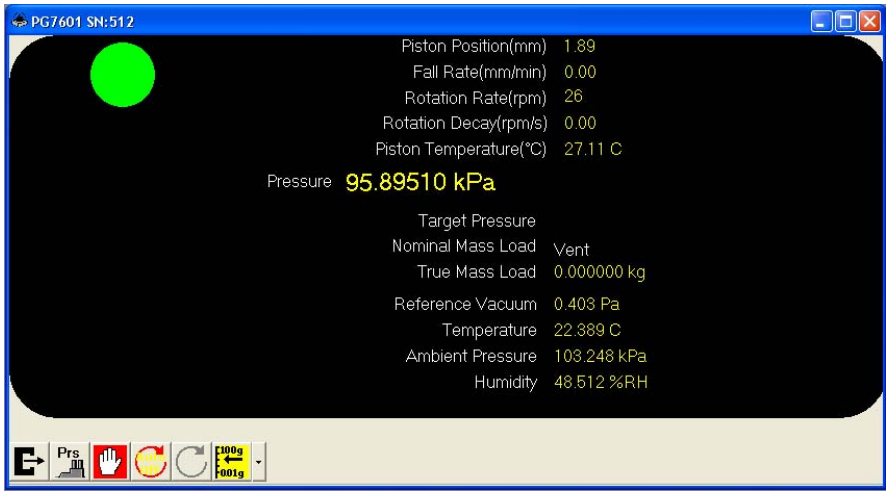

Figure 64. Example PG7000 Run Screen

6.3.6 EXAMPLE #5 (PG7000, GENERIC PISTON GAUGE)

How do I setup my PG7000 provide sensory output information, but use COMPASS to calculate the reference pressure?

This setup is useful when there are several piston gauge platforms or piston cylinders available at any given time. Allowing **COMPASS** to perform the calculations prevents the need to setup each PG7000 terminal with the proper information each time an element is re-calibrated. Only the **COMPASS** setup requires and update. The Test Initialization time is also reduced since the elements do not have to be re-loaded from the PG70000 base prior to running each test.

- To begin create a PG7000 as described in 6.3.5, Example #4. All outputs provided by the PG7000 can be used individually by **COMPASS**.

- Use the **PG7000** setup extractor to update the **COMPASS** database with all piston-cylinders, mass sets and mass bells currently defined in the PG7000 (see 17).

- Use the **Piston Gauge Platform Editor** to create a new device. Do not check the **<Autodetect Setup>** option. Enter calibration information on the **[Calibration]** tab. Use the **[P-C/MS]** tab to select the specific elements to use with the platform. The **<Support All>** option is a good place to start.

- Select the outputs provided by the auto detected PG7000 Base setup in step 1 for the sources on the **[Sources]** tab. **COMPASS** will use the outputs of the auto detected PG7000 base to determine, piston and vacuum information for this piston gauge setup.

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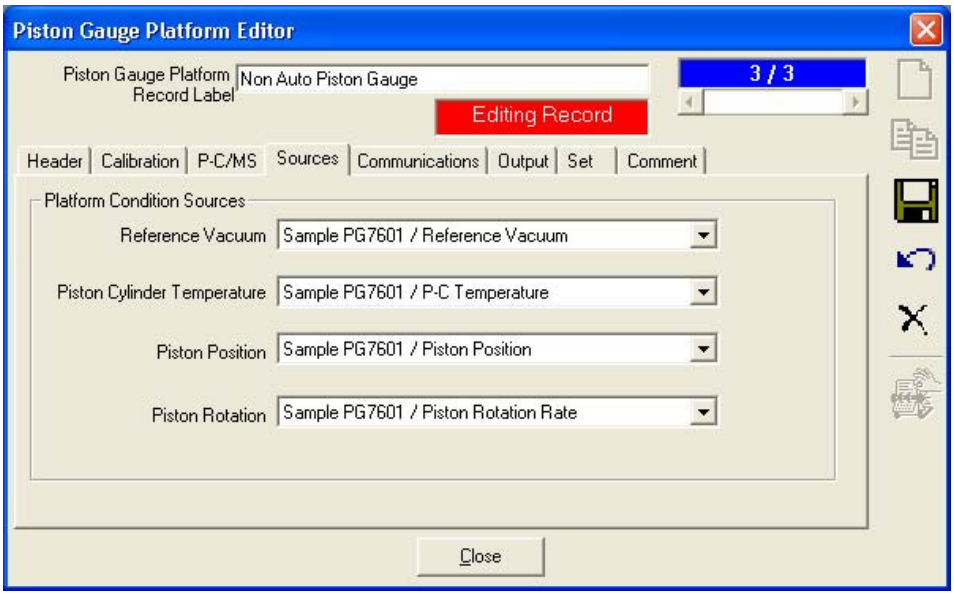

Figure 65. PG7000 Setup Sources

- Outputs and communications settings are not required. Save the platform definition.

- To test the setup run a manual test and select the new platform as the reference. Choose the **[Run],[Run Manual Test]** menu choice to start a manual test (see 7.5, [Run], [Run Manual Test]). Do not select a DUT at this time. The goal of this run is to simply verify that the piston gauge setup is valid. Press **[Next]** to proceed to the next Test Initialization step (see 7.3.5, Verify/Select Test Hardware). Select the new piston gauge platform as the **<Reference Pressure>** and the auto detected PG7000 for **<Ambient Pressure>**, **<Ambient Temperature>** and **<Ambient Humidity>**.

Devices are selected by their <Record Label> and <Serial Number> by default. Change how devices are selected by changing test initialization options (see 14.3, [Initialize Test] Tab). The selection in Figure 62 is based on <Record Label> and <Output Label>

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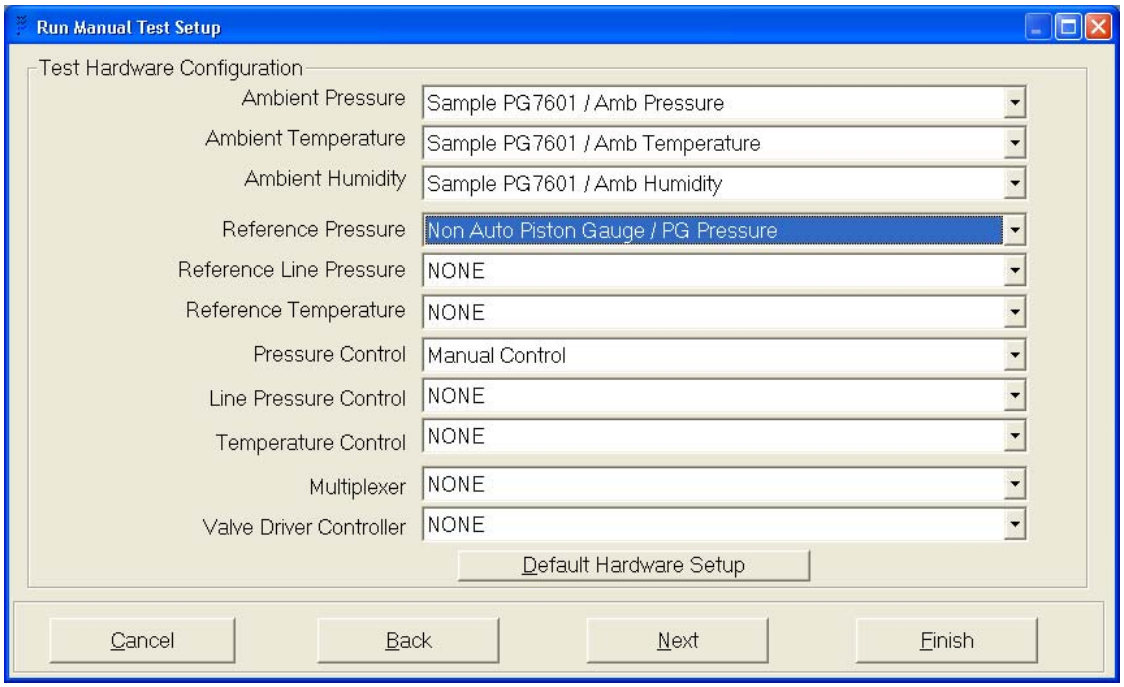

Figure 66. Example PG7000 Hardware Selection

- Press **[Next]** until the piston gauge platform setup screen displays. Choose the measurement mode, piston cylinder, mass set and mass bell to use. The items in each list are determined by the selects on the **[P-C/MS]** tab in the **Piston Gauge Platform Editor**. Select the metrological elements to use for the test. The sources defined in the piston gauge platform definition are automatically selected on the right side of the display (see **Figure 67**). New sources can be selected if desired.

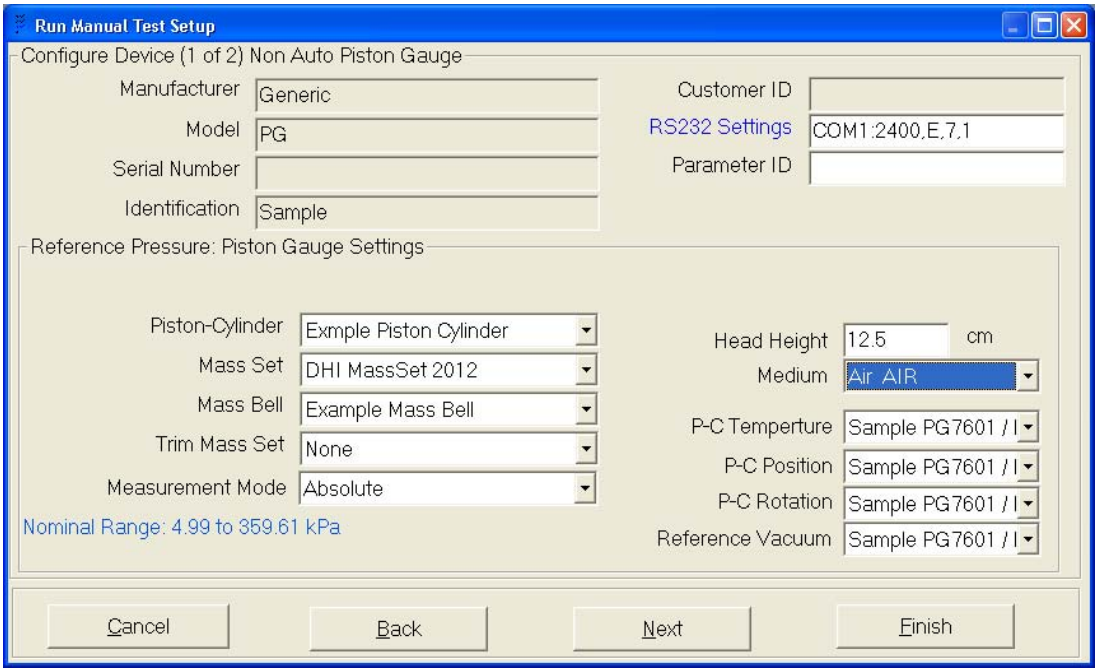

Figure 67. Manual piston gauge device Configuration

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- Press **[Next]** to setup the auto detected PG7000. Press **[Next]** again or the **[Load Settings]** button to load the basic PG7000 information. This loading process is very fast because the individual piston-cylinder, mass set and mass bell data does not need to be loaded. This device configuration step does not require any specific selections (see **Figure 68**).

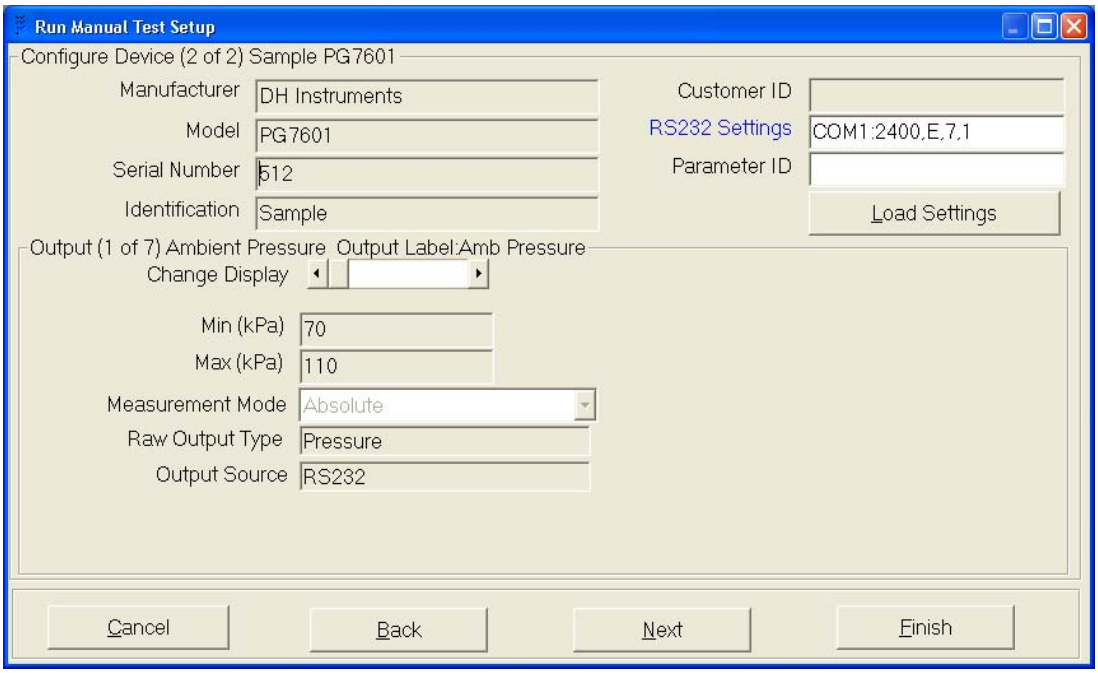

Figure 68. PG7000 Base used for sensory output

Press **[Finish]** to complete the initialization process and begin polling the PG7000 outputs. The **PG7000 Run Screen** should not be used as the main interface. The pressure on this form and on the PG7000 terminal is not valid. This setup uses the PG7000 for sensory output only. Instead the **Piston Gauge Device Output Run Screen** should be used to view and change the current pressure (see 5.5.5). Notice that outputs that are read remotely by the PG7000 are displayed in black and updated automatically (see

- **Figure 69**). Use the features on the toolbar to display the various output screens when they are not visible (see sections 5.4.2 (Run Display Tools).

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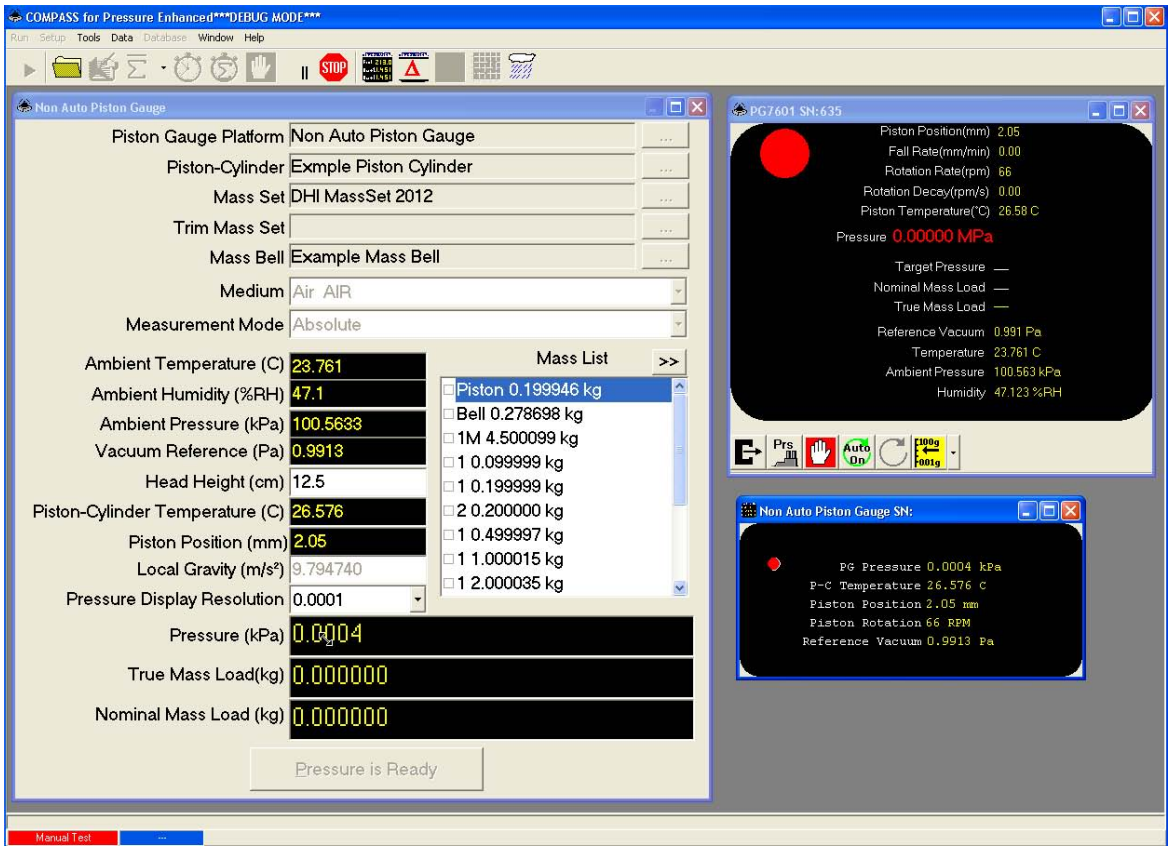

Figure 69. Manual Piston Gauge with autodetect PG7000 Base

6.3.7 EXAMPLE #6 (PG7000,AMH, PPC3)

How do I setup my PG7000 for automatic pressure control using an AMH and a PPC3?

This setup makes it possible to run fully automated tests with a PG7000. The specific controller used is not important from a **COMPASS** perspective. The **COMPASS** setup is the same whether a PPC2+, PPC3 or a PPCH is used to control the pressure. It is up to the user to setup the PG7000, AMH and PPC3 as described by the PG7000 operation and maintenance manual. The typical RS232 connections are described in **Figure 70**.

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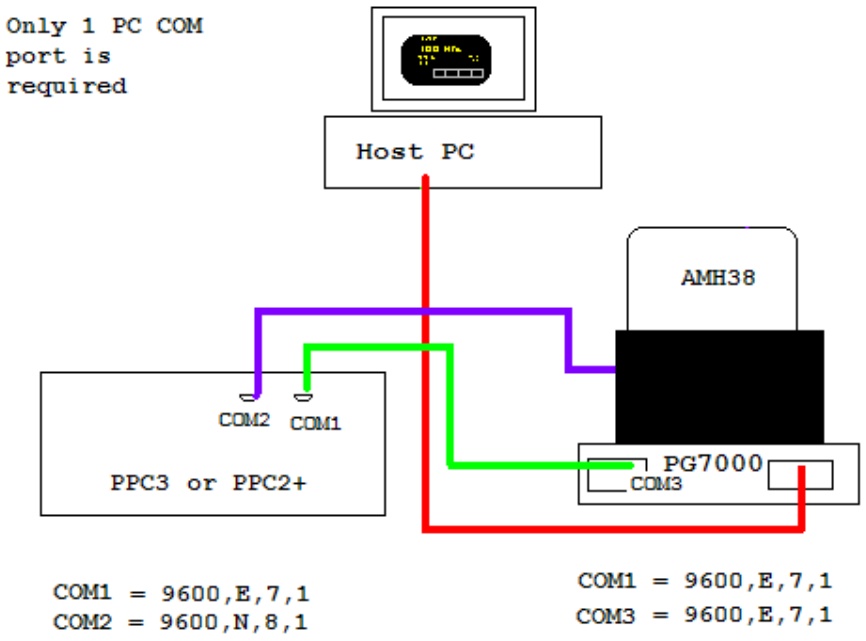

Figure 70. PG7000 AMH, PPC RS232 Connections

- Setup the PG7000, PPC3 and the AMH as described by the PG7000 Operation and maintenance manual. Automatic pressure generation should be fully functional from the PG7000 terminal prior to running a test with **COMPASS**.

- Define a piston gauge platform with the autodetect option enabled (see 6.3.5, Example #4).

- At this point the setup is complete. When running a Test Definition or a Manual Test, select the AMH mass set and corresponding mass bell during Test Initialization (see 7.3.3.3). This step is no different than for any other PG7000 setup. AMH mass sets display with an "A" following the serial number. This is the same designation used on the PG7000 Terminal. When the AMH mass set is used, each target pressure automatically changes the AMH mass load. However, automatic pressure generation must be turned on separately.

- When running a Manual Test, use the tools on the **PG7000 Run Screen** to engage automatic pressure generation and automatic rotation (see 5.5.6.1). Enter a target pressure and press **[Enter]** to set a new target pressure. This is equivalent to entering a new target pressure on the PG7000 terminal. If the mass loading resolution is 100g, no prompts to load trim mass will follow. If the mass loading resolution is less than 100g, a separate prompt to load the required trim mass displays. The test operator must load this trim mass and acknowledge the test prompt before automatic pressure generation will continue.

- A Test Definition must specify automatic pressure generation and rotation to automatically control pressure with the PG7000 AMH setup. Edit or create a new Test Definition (see 8, [Setup], [Test]). Define the test points, dwell, averaging time and any other test specific settings. Select the PG7000 as the reference. The controller will display as **<Manual Control>**. This is the default selection for a piston gauge and the selection used even when automatic pressure generation is active. On the **[Set]** child tab, check all of the generation options and enter a generation deadband suitable for the test (see **Figure 71**). A deadband of 1.5mm is the default value and suitable for most applications. When all entries are complete, save the Test Definition.

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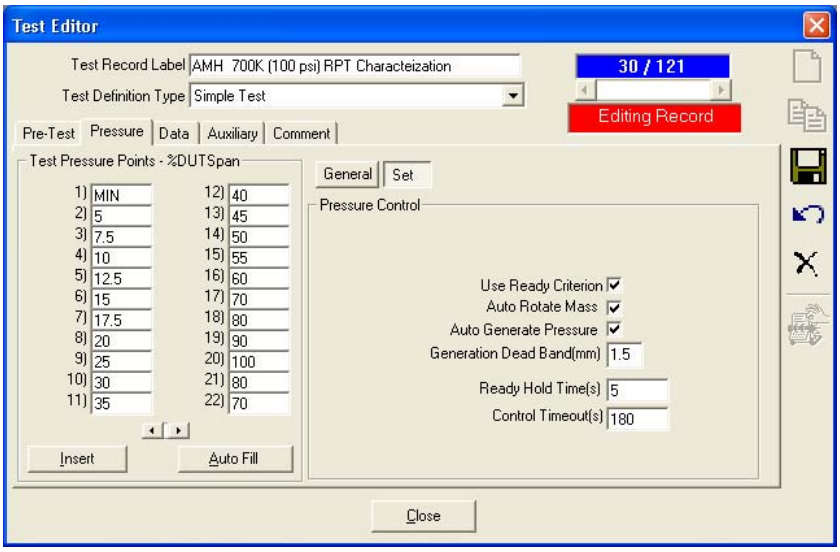

Figure 71. PG7000 AMH, Test Definition Set Requirements

- Run the Test Definition by using the [Run], [Run Test] menu choice. Complete the Test Initialization process by selecting DUTs and the Test Definition when prompted. On the Test Hardware Verification step, the selected pressure reference should be an auto detected PG7000 and the pressure reference should be **<Manual Entry>** (see 7.3.5, Verify/Select Test Hardware). The remaining initialization test steps do not have any special requirements. The key for automatic pressure generation is that the Test Definition specifies automatic pressure generation.

6.3.8 EXAMPLE #7 (MENSOR PCS-400)

How do I setup my mensor PCS-400 pressure controller?

Use this setup to fully automate the pressure measurement and control with a mensor controller. The steps in defining a 3rd party controller are the same regardless of the manufacturer. Only the specific remote commands and range information are different. When the setup is complete, any number of Test Definitions can be created to automate calibrations using the controller as a reference or as a DUT. **COMPASS for Pressure Enhanced** is required to use this functionality. Only DHI controllers and references are available for use remotely with **COMPASS for Pressure Basic**.

- Define a new support device using the **Support Device Editor**. Use the fields on the **[Header]** tab to describe the device (see **Figure 72**). The fields on the **[Calibration]** tab are not required. The fields are available for reporting and can be used to limit device availability based on calibration date and M&TE (see 14.3, [Initialize Test] Tab).

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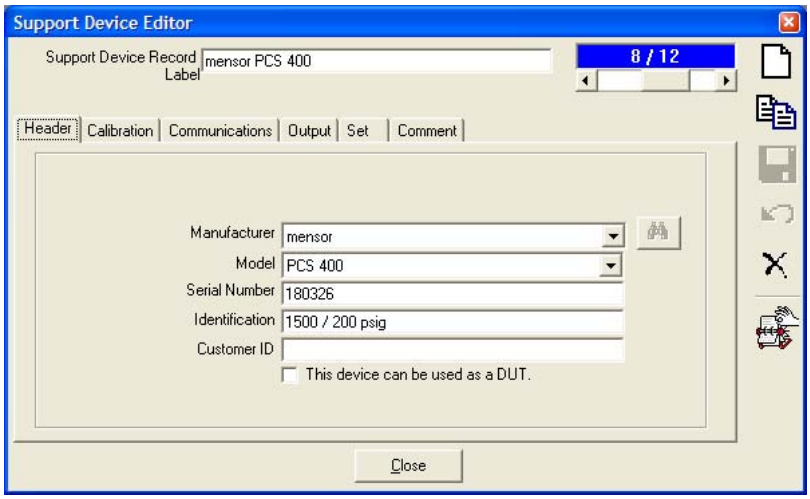

Figure 72. mensor PCS-400 Header Setup

- Define the remote interface settings to the controller by using the **[Communications]** tab. Be sure to set the Command Terminator to <CR> only.

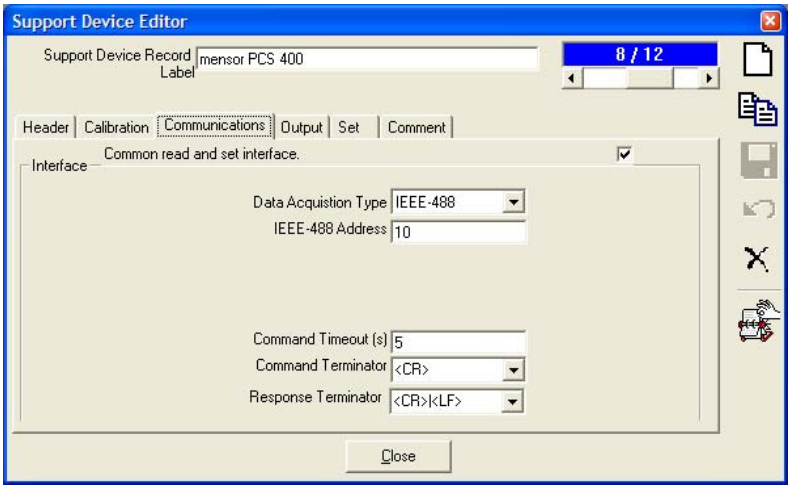

Figure 73. mensor PCS-400 Communications Setup

- The **[Output]** tab tells **COMPASS** what outputs are available and how to read them. Select the **[Output]** tab and press **[Add]** button (or **[Edit]**). The **Output Relationship Editor** displays. The Output relationship defines the span of the controller output, the source of this data, and any manipulation required to get the data in a recognizable format (ie: scaling a mV output to a pressure value). For this example assume that the controller has a range of 0-1500 psi. The **<Relationship>** selection should be **<Same>** since the raw output value of the controller is a pressure. The required settings for the raw and final outputs are in **Figure 74**. Press **[OK]** to close the **Output Relationship Editor** and return to the **Support Device Editor**.

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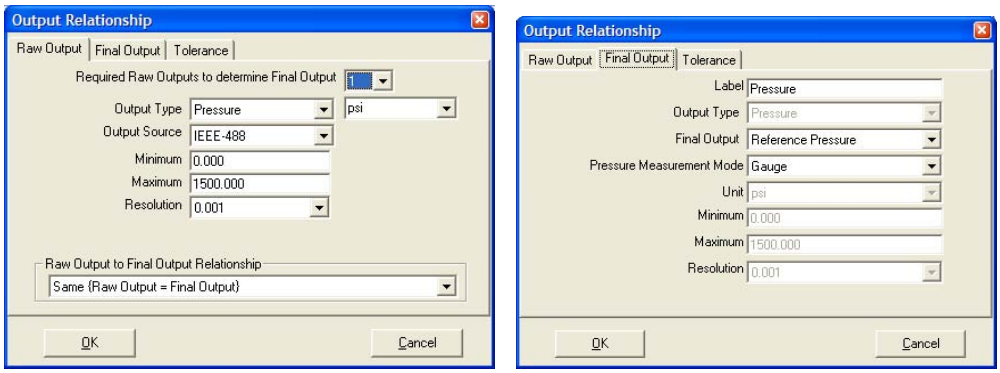

Figure 74. mensor PCS-400 Output Relationship

- Press the **[Edit Command]** button on the **[Output]** tab to create the command to read the pressure. The **Remote Command Editor** displays to facilitate the entry of the remote commands (see **Figure 75**). Enter the remote command and press the **[Save]** toolbar option then press **[OK]** to close the **Remote Command Editor**. An Initialization command is not used in this setup. Therefore it is important that the test operator verify that the controller is in the correct range, measurement mode and unit of measure prior to running a test. NOTE: mensor software ver 2.74 does not support a general READ command, therefore the "_PCS4,OUTFORM,1" command is used to return a pressure value.

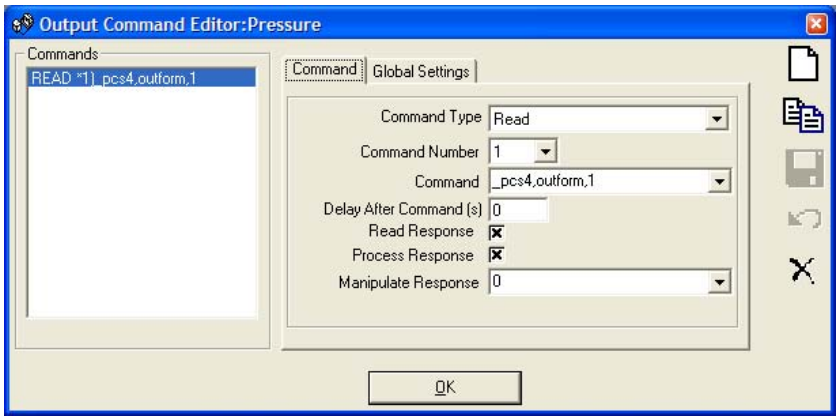

Figure 75. mensor PCS-400 Remote Command Setup

- The output definition is complete. To create other outputs using a different pressure range or measurement mode, press the **[Copy]** button on the **[Output]** tab. Edit the output and change the range and unit of measure as desired. All outputs created are available as pressure references. To simplify the selection of each range, use a specific **<Final Output>** label for each unique range.
- Select the **[Set]** tab to define a controllable output. Outputs defined on the **[Set]** tab are used for control. Press **[Add]** to create a new Set. The **Set Relationship Editor** will display. Enter the source, range and unit of measure information required for the controller. The defined output range was 0-1500 psi so the control range should also be 0-1500 psi (see **Figure 76**). Press **[OK]** to return to the **[Set]** tab.

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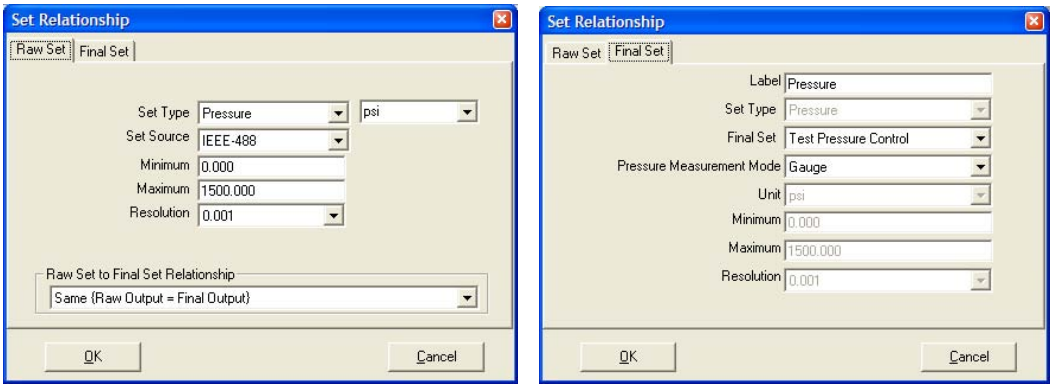

Figure 76. mensor PCS-400 Set Relationship

- Define the remote commands to change the target pressure. Press the **[Edit Commands]** button to display the **Remote Command Editor**. This setup will use an Initialization command to ensure that the PCS-400 is in a VENT condition before the start of a test. Initialization commands are sent only 1 time at the end of the Test Initialization process. Click the **[New]** toolbar option and define the initialization command (see **Figure 77**). Press the **[Save]** toolbar option and again press the **[New]** toolbar option to create the set command (see **Figure 78**). The set command will use the **<Replace [x]>** option to alter the remote command as required by each new target pressure (see **Error! Reference source not found.**). Click the **[Save]** toolbar option before pressing **[OK]**.

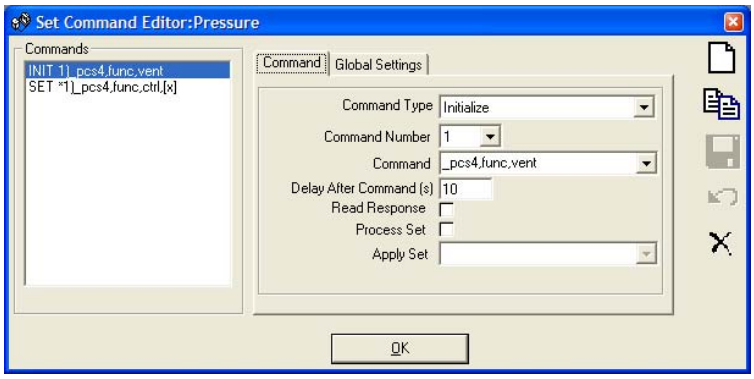

Figure 77. mensor PCS-400 Initialization Command Setup

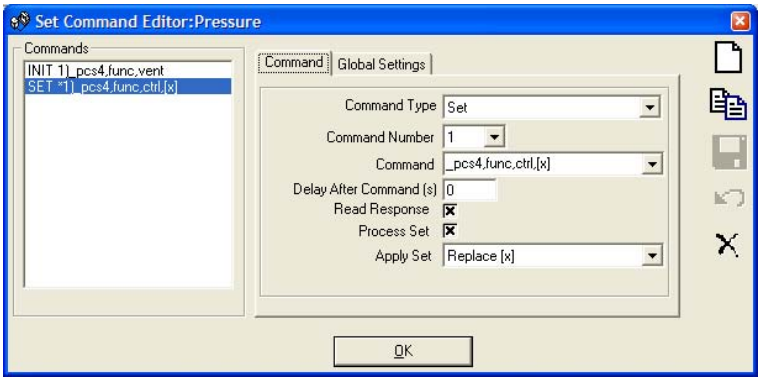

Figure 78. mensor PCS-400 Set Command Setup

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- Define a vent command setup to allow **COMPASS** to vent the controller as required by a Test Definition (see 4.4.3.1). Click the **<Use Remote Vent>** option and press the **[Edit Vent Command(s)]** button (see **Figure 79**). Define the vent command in the **Remote Command Editor** (see **Figure 80**).

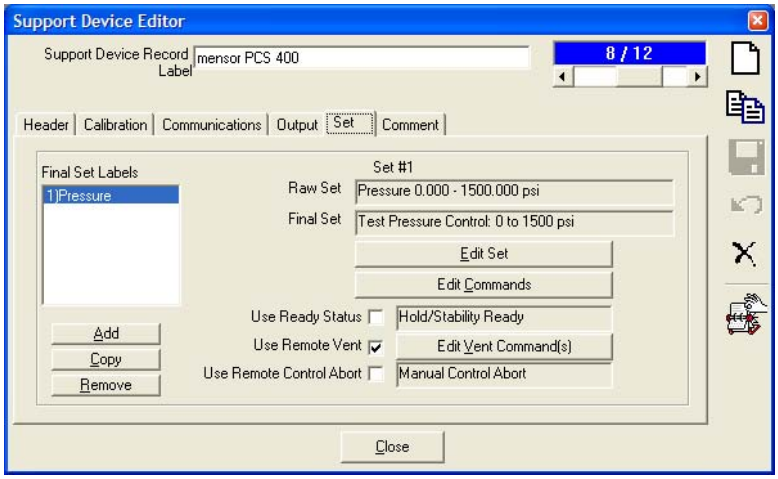

Figure 79. mensor PCS-400 Vent Command Selection

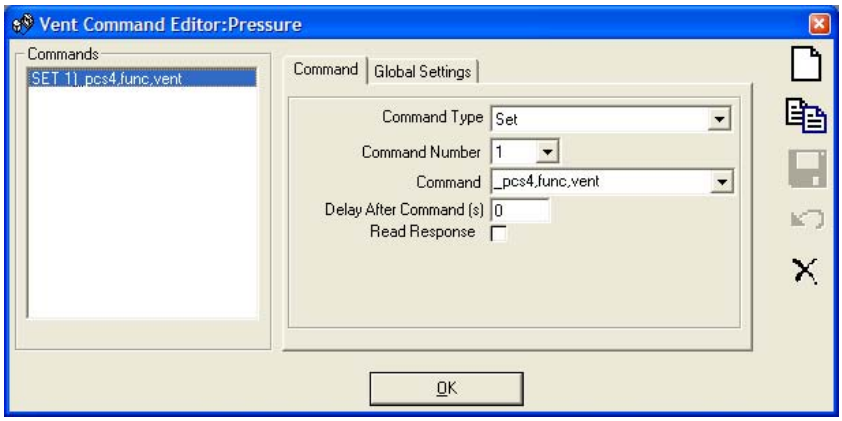

Figure 80. mensor PCS-400 Vent Command Setup

- Save the support device. The controller will be available for use as a controller and as a reference when initializing a test.

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7. RUN MODES

7.1 OVERVIEW

Run mode describes the automatic execution function that **COMPASS** is in. Typically, instruments are polled over their remote interface while in a run mode. The top of the main screen always displays the current run mode. All run modes support the ability to log data to a Data File. **COMPASS** has three run modes:

Idle — No run mode is active. Menu items such as **[Setup]** can only be accessed in this mode. They are not available in active run modes.

Run Test Definition — Activated by the **[Run], [Run Test]** menu option. This run mode is to run a Test Definition to follow pre-defined test parameters and run a specified test sequence.

Run Manual Test — Activated by the **[Run], [Run Manual Test]** menu option. This run mode allows any combination of test hardware and DUTs to be specified. There is no pre-defined test sequence. Pressures can be set as desired and data can be taken at well by pressing the appropriate data acquisition option on the **<Main>** Toolbar.

Other than **<Idle>**, which indicates that **COMPASS** is in a state in which configuration changes can be made, each of these run modes is found in the **[Run]** menu on the main program. Before activating a run mode, make sure that all instruments that will be used to run are properly configured and remotely connected to the host PC. This will prevent interface time-outs that will interrupt the test initialization process.

7.2 [RUN], [RUN TEST]

This menu selection is used to begin test execution using a Test Definition. Test Definitions define specific test parameters and a test sequence. Data is collected according to the Test Definition sequence. At the end of a test, custom reports can be generated. The execution of **[Run Test]** has three main sequential steps:

❶ **Test Initialization:** Select DUTs, support devices, verify and select test controllers and references to use for testing. Use preferences on the **[Tools]**, **[Options]**, **[Initialize Test]** tab to impose limitations on devices available for testing.

❷ **Run Test Sequence:** Runs leak test (if included) and pressure exercise (if included) followed by the test points taking data at each point based on the test data selections. For details on how a test sequence is defined in the Test Definition. Certain aspects of how a test runs can be customized using the **[Tools]**, **[Options]**, **[Run Test]** and **[End Test]** tabs.

❸ **End Test:** Presents the Test Notes screen to record test specific notes and the Test Complete screen with various test conclusion options. Certain aspects of the test conclusion can be customized using the **[Tools]**, **[Options]**, **[End Test]** tab (see 14.5, [End Test] tab).

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7.3 TEST INITIALIZATION

The Run Test Setup dialog is used to initialize **COMPASS** tests. Use the **[Back]**, **[Next]**, and/or **[Finish]** buttons to move through the test initialization steps. Each step in the test initialization process requires valid selections to proceed to the next step. Press the **[Finish]** button to automatically complete the remaining test steps and begin running the test. If any user input is required, the automatic initialization halts and a prompt for the necessary input is presented. The following sections detail the Test Initialization process.

❶ Select Test Units/User ID:

Specify the units of measure to use for the test pressure, line pressure and test temperature points and confirm/enter the User ID. Units selected for quantities not used have no effect on the test.

❷ Select DUT(s):

Choose the DUT or DUTs for testing. Depending on the Test Definition, a DUT is not required. Double click DUTs in the grid to use them for testing (see 7.3.2, Select DUT(s)).

❸ Configure DUT(s):

Make selections specific to the DUT such as range and serial number information for profile DUTs. Specific support hardware required by the DUT is selected at this time (see 7.3.3, Configure DUT(s)/Devices).

❹ Select Test:

Select the Test Definition to use. By default, the Test Definition associated with the first DUT is selected. If the first DUT does not include a Test Definition, the last used Test Definition is selected by default. Double click the desired Test Definition to use (see 7.3.4, Select Test).

❺ Verify Test Hardware:

References and controllers defined in the test are listed for verification. If the Test Definition is not locked, the specific test hardware selections can be altered.

❻ Configure Test Hardware:

Make selections specific to each configured device. In most cases only specific range selections and/or remote interface settings need be changed in this step. The process is functionally identical to the DUT configuration step (see 7.3.6, Configure Test).

❻ Final Verification:

The DUT and reference output ranges display for final verification. There are no required selections on this final step. Press **[Back]** to alter device settings or press **[Finish]** to complete the process (see 7.3.7, Final Verification).

Various aspects of the Test Initialization process can be customized by using the options found on the [Tools], [Options], [Initialize Test] tab (see 14.3).

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7.3.1 SELECT UNITS OF MEASURE

Specify the units of measure to use for the test pressure, line pressure and test temperature points and confirm/enter the User ID. The units selected are used to display the min and max outputs of devices that read or set the corresponding quantities. When running a manual test, the selected units are always used to log data in the data file. When running a Test Definition, the unit specified by the test is always used to log data. When the test uses a %DUTSpan unit selection, the DUTs output unit is used.

The last test user name is automatically selected in the **<Select/Enter User Name>** field. If the desired user name is not in the list, enter a new user name by directly typing in the field.

COMPASS stores all settings specific to each test executed, DUTs, selected ranges, units of measure, changes in remote interface settings ect. This makes it possible to press the **[Finish]** button at any time during the test initialization process to automatically use the settings from the previous test. When the previous test is completely unrelated to the test under initialization, press the **[Clear Previous Selections]** button to remove information from the last test executed. This may also be necessary if many devices used from the previous test are no longer available or if they were significantly altered.

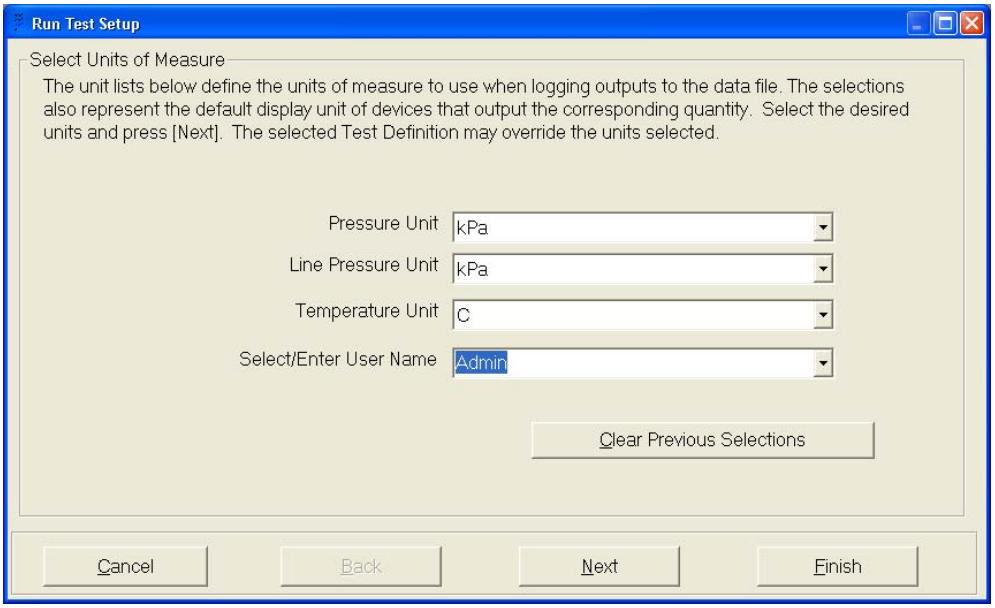
Run Test Setup
Select Units of Measure
The unit lists below define the units of measure to use when logging outputs to the data file. The selections also represent the default display unit of devices that output the corresponding quantity. Select the desired units and press [Next]. The selected Test Definition may override the units selected.
Pressure Unit
kPa
Line Pressure Unit
kPa
Temperature Unit
C
Select/Enter User Name
Admin
Clear Previous Selections
Cancel
Back
Next
Finish

Figure 81. Run Test Setup Select Units of Measure

7.3.2 SELECT DUT(S)

The Select DUTs Initialization Step is provided to allow DUTs to be selected for Testing. A grid of all available DUTs displays at the top of the dialog. This list is composed of all final outputs specified as DUT pressure or General Pressure and Piston Gauge Platforms that are designated as possible DUTs. DUTs are listed by record label, manufacturer, model, serial number, final output label, identification, and customer identification. Use the final output label to distinguish between multiple DUT final outputs on a single instrument.

Double click items in the DUT grid to add them to the list for testing. Double click items in the selected list or press the [Remove] button to remove them.

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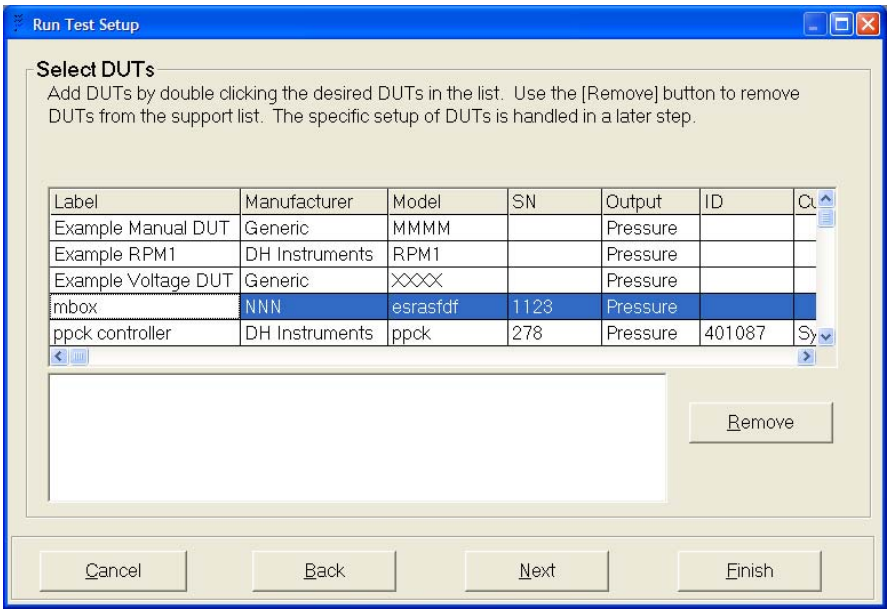

Figure 82. Run Test Setup Select DUTs

When a DUT profile is selected more than 1 time, an option to enter the number of DUTs is presented. Up to 50 DUTs can be entered for a single DUT profile. Range and identification information for each profile DUT must be specified on the Configure DUT Initialization step.

Although COMPASS does not impose a limit on the number of DUTs, it is recommended that no more than 20 DUTs be specified. Too many DUTs may require excessive test averaging times to guarantee a new update from each instrument. Never choose more DUTs than is practical for the support hardware and data acquisition methods.

A DUT selection is not required. Manual Tests and Tests that do not include DUT based criterion can run without a DUT selection. A warning message displays when a DUT is not selected. Use the **[Tools]**, **[Options]**, **[Initialization]** tab to prevent this warning message.

When all DUTs are selected press the **[Next]** button to proceed to the next Test Initialization step.

7.3.3 CONFIGURE DUT(S)/DEVICES

This Test Initialization step is provided to select settings specific to the DUT. The basic device header information and final output range of the device display. In some cases there are no selections available or required to proceed to the next step. In other cases, settings specific to the DUT must be specified. The options available in this step depend on the selections in the device definition. Make settings appropriate for the device then press **[Next]** to continue with the setup of the next DUT or test step.

Profile based DUTs require the entry of at least one of the identifying fields: serial number, identification, and or customer identification. In addition the range information must be entered. An example of a profile DUT setup is provided in **Figure 83**.

Edit the remote interface of a device by clicking the interface field and changing the settings as desired. These changes are not saved in the database and only effect the current test run.

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Click the label next to the interface to change the interface type. For example from RS232 to IEEE-488.

Select an **<Output Source>** when the Final Output is not the remote interface of the device. This is typically the case for voltage output DUTs. In this case the **<Output Source>** selection should specify the voltage source for the device. The list of available choices is limited to devices that support the required output of the device. The Default Hardware Configuration can be used to provide default support device elements to prevent this selection.

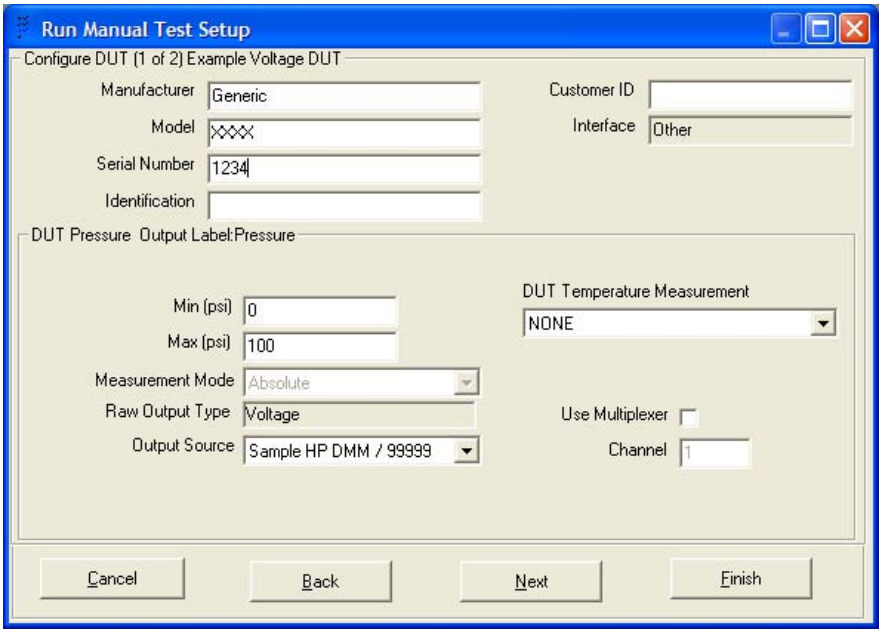

Figure 83. Configure DUT Step – Profile DUT

DUTs have the option to log temperature in addition to their pressure output. The **<DUT Temperature Measurement>** listbox contains a list of all devices designated as General Temperature and DUT Temperature. If desired select a DUT temperature measuring device. DUT temperature measurement of this type is typically not necessary unless a test that varies temperature is executed. Do not select a temperature measuring device if one is already required to convert the DUT Raw Output into a pressure, in this case, the temperature measuring device will be selected as a raw output source.

To use a multiplexer, check the **<Use Multiplexer>** option and enter a **<Channel>** number to latch the update of a raw output to a specific channel on a multiplexer. Although the channels are designated as 0 to n, the physical state of the multiplexer can include setting a variety of channels. The remote command setup for the multiplexer must handle the specific channel setup (see 4.4.3.2, Multiplexer/Valve Driver). The remote command setup of the multiplexer allows a Macro to be used to handle the more involved multiplexer states. When this option is used, the final output of the device is only updated when the multiplexer is set to read the selected channel.

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7.3.3.1 MULITPLE RAW OUTPUT DEVICES

Devices that use more than 1 Raw Output require more than 1 **<Output Source>** selection. A separate **<Output Source>** selection is available for each raw output (see **Figure 84**). The selected devices are not configured at this step in the test initialization process. When the configured Output Source is a standard **COMPASS** output device such as Ambient Pressure, Line Pressure, Reference Pressure, etc., the actual device selection will be made during the Test Hardware Initialization step.

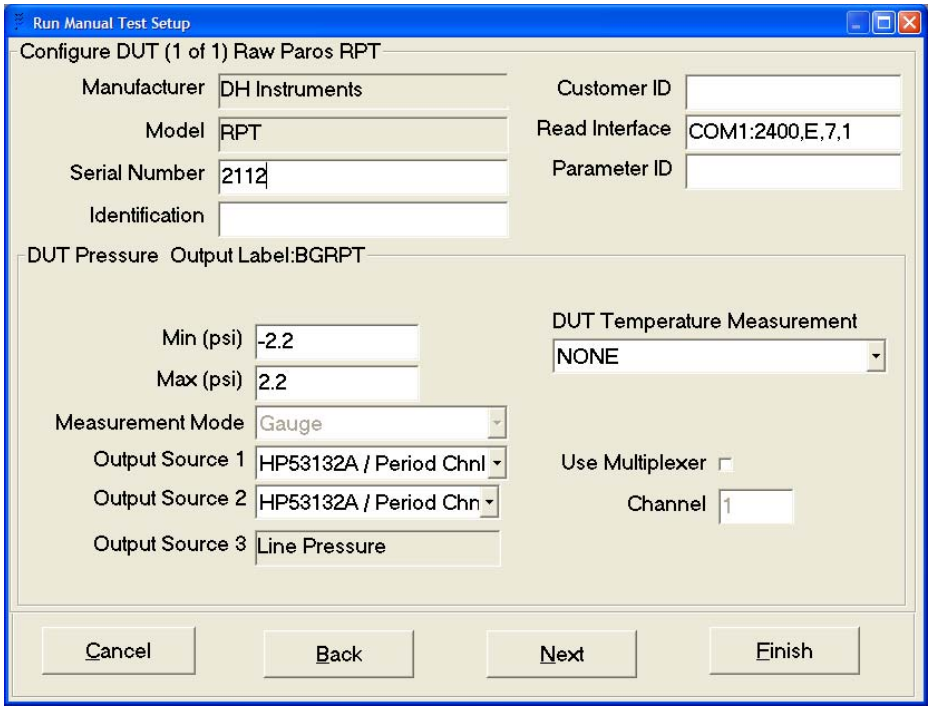

Figure 84. Configure DUT Step – Mulitiple Raw Output DUT

7.3.3.2 CONFIGURE DHI DEVICE

When a DH Instruments product that is setup with the **<Auto Detect Settings>** option is configured, a **[Load Settings]** button is included at the top of the dialog (see Figure 85). Press this button to load the range information of the product. When the settings are successfully loaded, the display changes to allow selection of the range to use for the test. Select the measurement mode, range and Auto Zero state when applicable. In all products except the PPC3, the **<Min>** and **<Max>** final outputs are used for full scale and span based calculations only. The test range of the controller is always specified by the range selected from the list of ranges. When a PPC3 or RPM4 is configured and **<Auto Range>** is selected, the **<Min>** and **<Max>** entries are also used to auto range the device (refer to the PPC3 and RPM4 Operation and Maintenance Manuals for further instructions).

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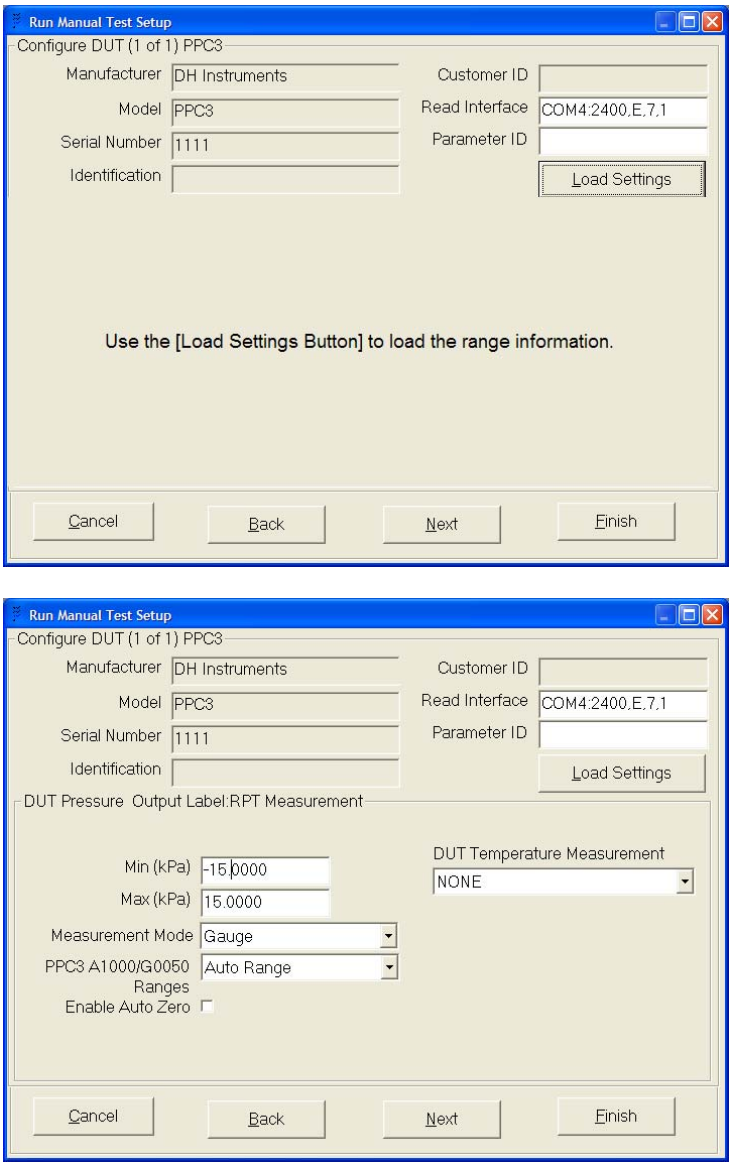

Figure 85. Configure DUT Step – **DHI** Device

7.3.3.3 CONFIGURE PISTON GAUGE/DEADWEIGHT TESTER

To configure a Piston Gauge or Deadweight tester, the Piston-cylinder, Mass Set and Mass Bell must be specified to complete the setup. The nominal pressure range of the selected metrological elements displays at the bottom of the form.

When setting up a non **DHI** Piston Gauge, the choices available in the Piston-Cylinder, Mass Set, Mass Bell and Trim Mass Set lists are limited to those defined in the Piston Gauge Platform setup. In addition, piston sensing instruments can be selected to automatically acquire piston conditions such as temperature, rotation and position. These selections are not required.

When setting up a **DHI** PG7000 that has the **<Auto Detect Setup>** option selected, all Piston-cylinder, Mass Set and Mass Bell information stored inside the terminal is loaded when the **[Load Settings]** option is pressed. The available metrological element choices are automatically limited to those available in the terminal. All piston sensing options are not available as the PG7000 automatically handles all piston sensing duties.

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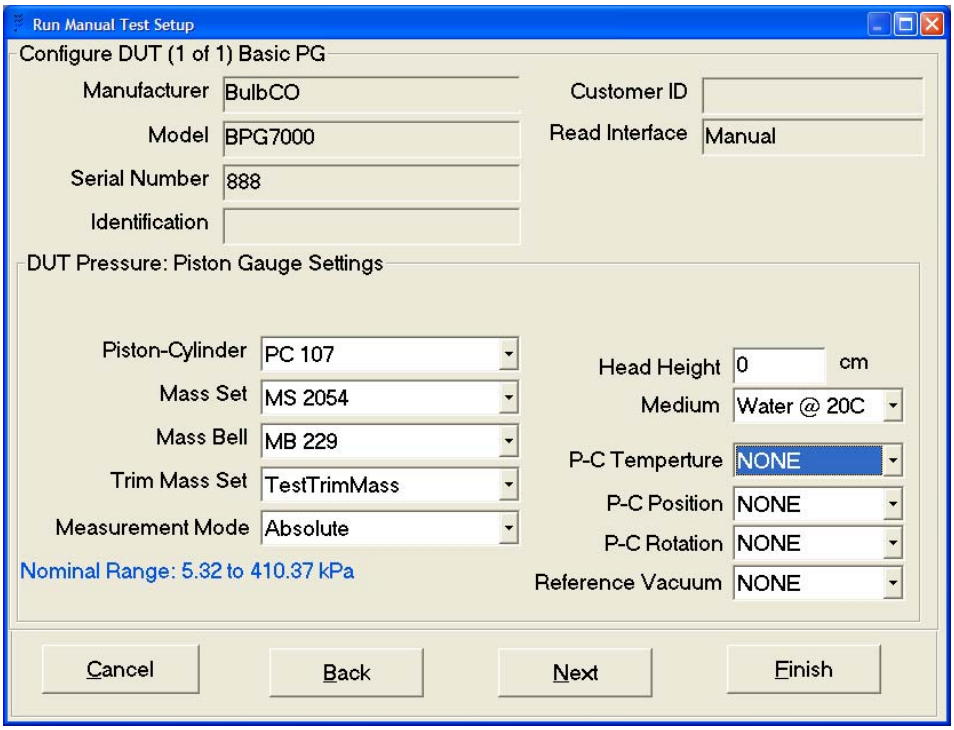

Figure 86. Configure Piston Gauge

7.3.4 SELECT TEST

The test selection step requires a Test Definition to be selected for testing. The screen contains the core information about the Test Definitions available. This information may be helpful in selecting the test to run. To select a test, double click it in the list of Test Definitions. Press **<View>** to display the Test Editor loaded with the information of the currently selected Test Definition (see **Figure 88**). Use the editor scroll bar to move to different Test Definitions if desired. Press **[Select]** on the Test Definition Editor to select the currently displayed Test Definition. When the desired test is selected, press **[Next]** to continue with the next test step.

Before continuing with the next test step, the Test Definition and DUT are compared to make sure that the measurement mode and test range are appropriate. Warnings and error messages display as needed to indicate an error condition.

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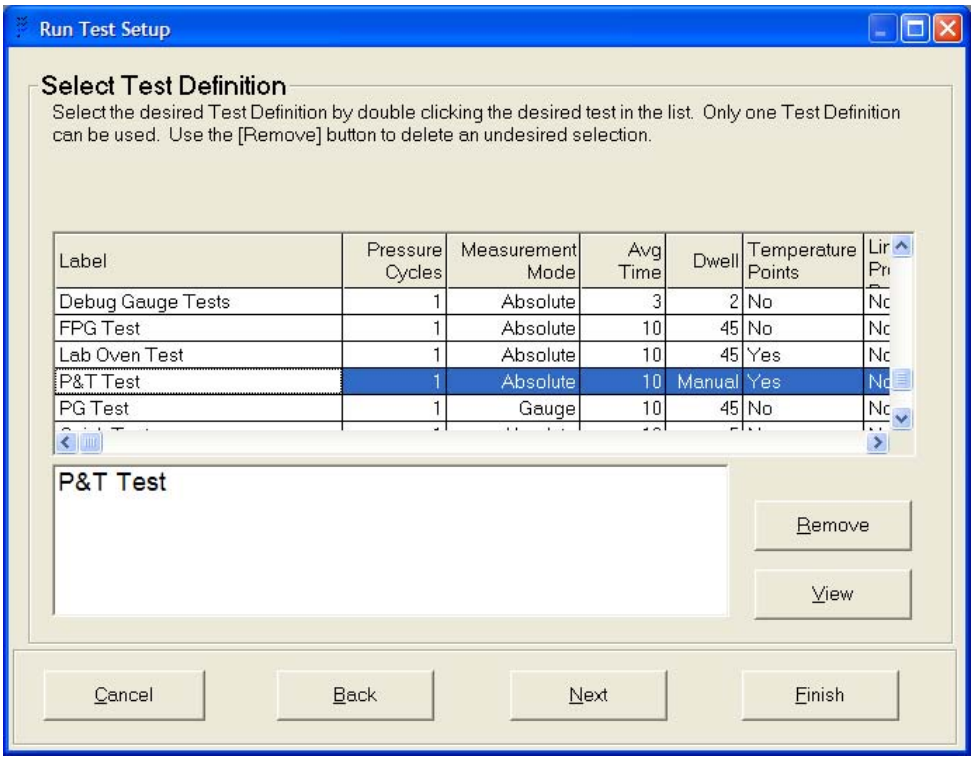
Run Test Setup
Select Test Definition
Select the desired Test Definition by double clicking the desired test in the list. Only one Test Definition can be used. Use the [Remove] button to delete an undesired selection.
Label
Pressure Cycles
Measurement Mode
Avg Time
Dwell
Temperature Points
Debug Gauge Tests 1 Absolute 3 2 No
FPG Test 1 Absolute 10 45 No
Lab Oven Test 1 Absolute 10 45 Yes
P&T Test 1 Absolute 10 Manual Yes
PG Test 1 Gauge 10 45 No
P&T Test
Remove
View
Cancel
Back
Next
Finish

Figure 87. Select Test Definition

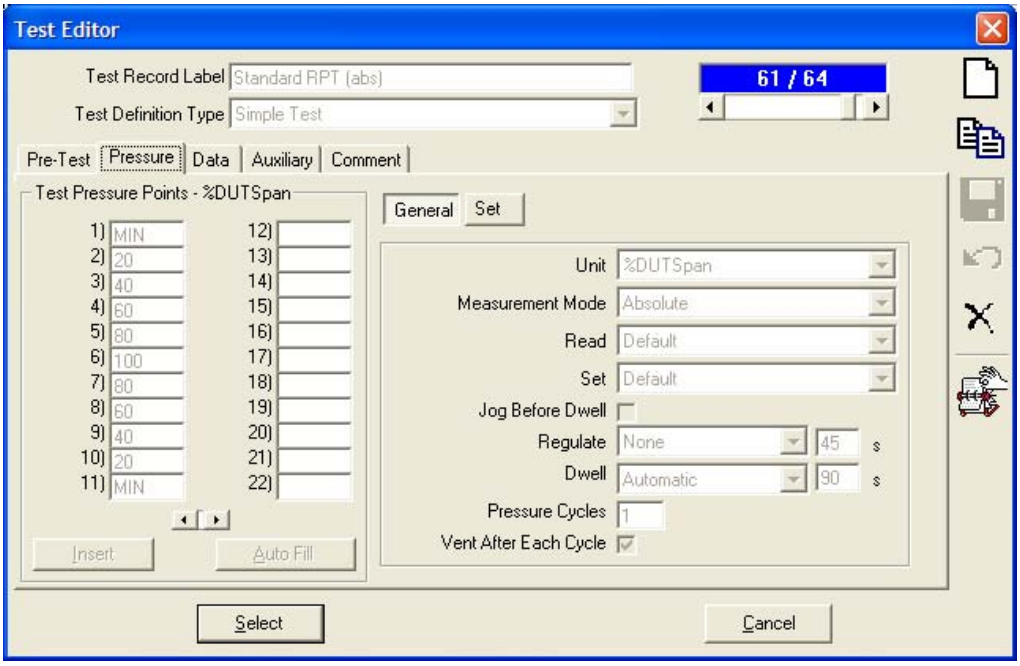
Test Editor
Test Record Label Standard RPT (abs)
Test Definition Type Simple Test
61 / 64
Pre-Test Pressure Data Auxiliary Comment
Test Pressure Points - %DUTSpan
1) MIN 2) 20 3) 40 4) 60 5) 80 6) 100 7) 80 8) 60 9) 40 10) 20 11) MIN
12) 13) 14) 15) 16) 17) 18) 19) 20) 21) 22)
Insert
Auto Fill
General Set
Unit %DUTSpan
Measurement Mode Absolute
Read Default
Set Default
Jog Before Dwell
Regulate None 45 s
Dwell Automatic 90 s
Pressure Cycles 1
Vent After Each Cycle
Select
Cancel

Figure 88. Select Test Definition using **<View>**

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7.3.5 VERIFY/SELECT TEST HARDWARE

This test initialization step allows the user to select the devices to use for ambient conditions, reference pressure and control, the test multiplexer and the test valve driver. By default, the selections defined in this step are those specified in the selected Test Definition. When running a manual test, this step always displays the last selections made when running a manual test. Press the **[Default Hardware Setup]** button at the bottom of the display to use the hardware specified in the **Default Hardware Configuration**. This option is not available when running a Test Definition with the **<Lock Setup>** option enabled (see 8.7, [Data] Tab).

If the Test Definition species <Default> for a reference or controller, the instrument selected in the Default Hardware Configuration option is used (see 12, [Setup], [Default Hardware Configuration]).

Test hardware cannot be modified when the selected Test Definition uses the <Lock Setup> option.

When the selected piston gauge is a DH Instruments PG7000, a [Tools], [Options], <Initialize Test> preference can be used to automatically select the ambient conditions output of the PG7000 as the ambient conditions source for the test.

When a piston gauge is selected as the pressure reference, the controller option defaults to <Manual Control>. If a controller is selected, it is assumed that the controller will change the mass and float the piston cylinder. COMPASS will not prompt the test operator to change the mass load. Instead, COMPASS will wait for a Ready output from the controller or wait for the piston position to be within the test defined Dead Band value. Review section Piston Gauge Ready/Not Ready, 3.3.5.4 for details on the Ready criterion of a piston gauge.

Use the drop down arrow next to each selection to select a new device. Each list of devices is populated according to the specified final output of the device. For example, the list of Ambient Pressure devices includes all instruments with a final output of Ambient Pressure and General Pressure.

The next step is the selection of Auxiliary Output Devices. This step is included only when the step is enabled in the **[Tools]**, **[Options]** test initialization. Up to 10 Auxiliary Output Devices can be used at a time. The intent of auxiliary devices is to allow users to acquire data from instruments that would otherwise be excluded from **COMPASS** data acquisition. Select the auxiliary devices in the display grid in the same way as DUTs.

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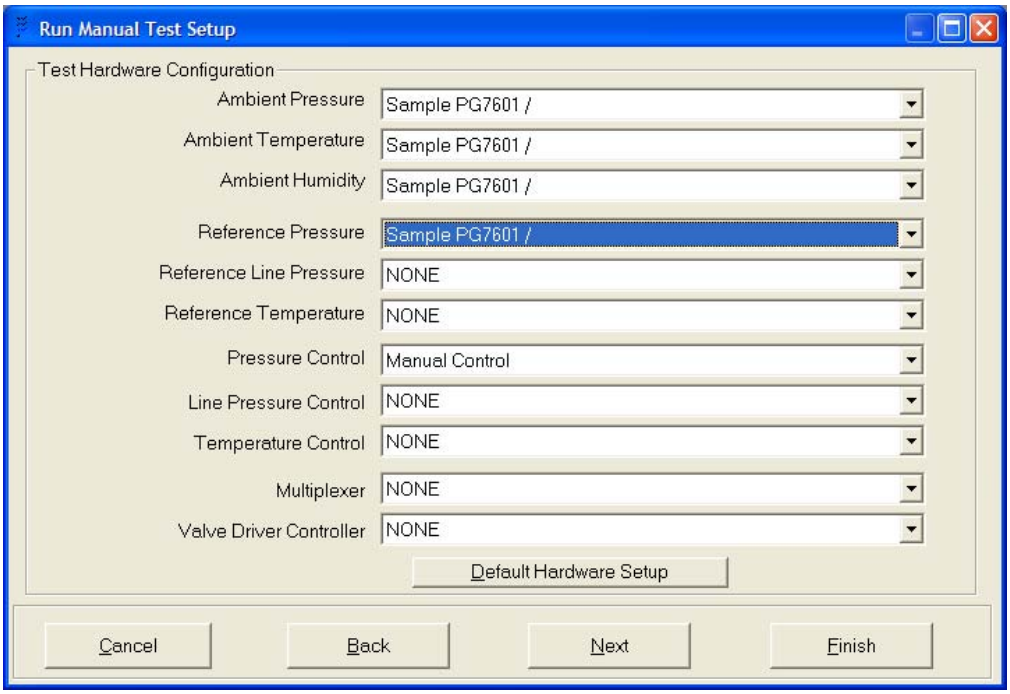

Figure 89. Test Hardware Configuration

7.3.6 CONFIGURE TEST HARDWARE

Configuring test hardware is identical to configuring DUTs. The exception is that non DUT hardware does not include a DUT Temperature selection. Since DUTs are the only devices that can be setup as profiles, non DUT devices will never support or require the entry of identification and range characteristics during initialization.

This configuration step supports the setup of all instruments including DUTs. This includes any support instruments such as DMMs and multiplexers as well as test reference and control devices. The process begins with the first non DUT device. Make selections appropriate to the device and press **[Next]** to proceed with the setup of the next device. Repeat these steps until all devices have been configured. When **[Next]** is pressed on the last device, the test initialization will continue to the final verification step.

7.3.7 FINAL VERIFICATION

The final verification step displays the current reference and DUT output ranges. There are no required selections. At this time also verify that all pneumatic and remote connections are secure and correct. When **[Next]** is pressed, **COMPASS** begins initializing all remote instruments by issuing their initialize remote commands. If this process does not generate any errors, **COMPASS** begins polling all remote instruments using their read commands. Any errors that occur will halt initialization. Use the **[Back]** and **[Next]** buttons as needed to correct errors associated with different test devices.

This is the end of the test initialization process. Program execution continues with the Run Test or Run Manual Test sequence.

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7.4 RUN TEST

After test initialization is complete run test begins. During run test the main menu bar is disabled but the run toolbar is active. Use the run toolbar buttons to view the current Test Definition while the test is running, to step test points back or forward or to display test Run Screens.

Various aspects of the Run Test Sequence can be customized (see 14.4, [Run Test] Tab) .

A separate Data File is created for each DUT.

A test that is running can be aborted at any time by pressing the **[Abort Test]** button on the run toolbar. Before aborting the test, **COMPASS** requires a second confirmation. When the test aborts, all system pressure is vented when the active pressure controller supports automatic venting. An additional query is used to determine if the partial Data File containing the data collected for the test so far should be saved. The Data File can be automatically deleted by using features on the **[Tools]**, **[Options]**, **<Data File>** tab.

A Test Definition that includes temperature, line pressure and test pressure points requires all test pressure points be set for each line pressure and each line pressure must be set for each test temperature. Therefore, a test that has 5 temperature points, 5 line pressure points and 10 test pressure points will log 500 data points. When more than one pressure cycle is defined in a Test Definition, each pressure point in each pressure cycle must be set for each line pressure. It is easy to see how a large number of points can be acquired by making a few options in the Test Definition.

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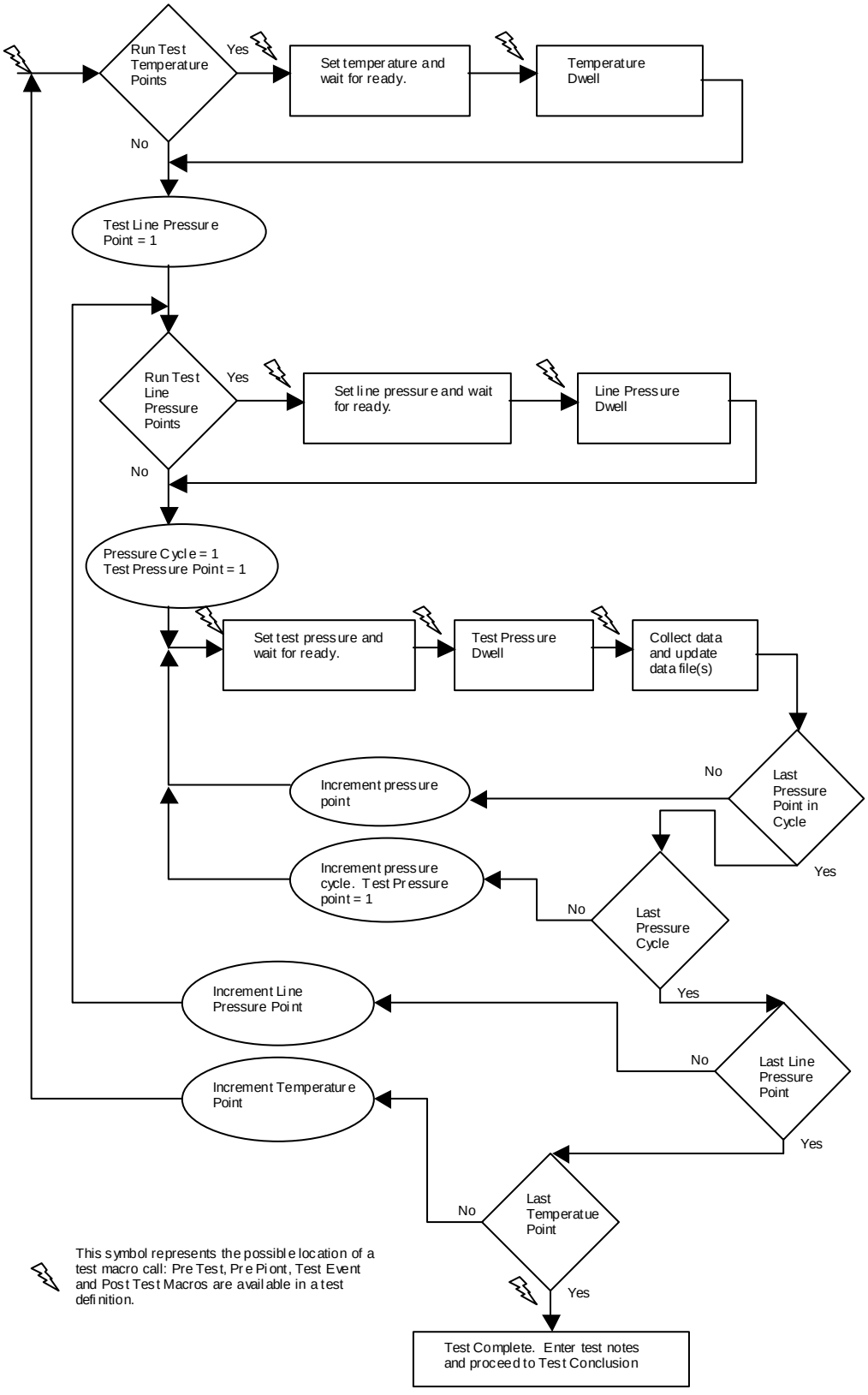
Run Test Temperature Points
Yes
Set temperature and wait for ready.
Temperature Dwell
No
Test Line Pressure Point = 1
Run Test Line Pressure Points
Yes
Set line pressure and wait for ready.
Line Pressure Dwell
No
Pressure Cycle = 1
Test Pressure Point = 1
Set test pressure and wait for ready.
Test Pressure Dwell
Collect data and update data file(s)
Last Pressure Point in Cycle
No
Yes
Increment pressure point
Last Pressure Cycle
No
Yes
Increment pressure cycle. Test Pressure point = 1
Last Line Pressure Point
No
Yes
Increment Line Pressure Point
Last Temperatue Point
No
Yes
Increment Temperature Point
This symbol represents the possible location of a test macro call: Pre Test, Pre Piont, Test Event and Post Test Macros are available in a test definition.
Test Complete. Enter test notes and proceed to Test Conclusion

Figure 90. Test Definition Flow Chart

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A more detailed look at the run test sequence follows:

When running a test, the [Back] and [Next] buttons are available to move through points in test execution. These buttons do not allow temperature or line pressure points to be skipped if present in a Test Definition. Only the setting and dwell portions of the point can be skipped

If a Test Event Macro is selected in the Test Definition, the macro is called prior to each step listed below. The cCOMPASS. CurrentTestStep property should be used in the macro to determine the current test step (see COMPASS Class, 28.9).

❶ **Run Pre-Test Macro**: If a pre Test Macro is specified in the Test Definition, it is executed as the first step in the test sequence. A pre-Test Macro can be used to adjust valve states, read device settings or handle any other systematic task that occurs at the beginning of the test.

❷ **Run Leak Test**: If a leak test is specified in the Test Definition and the reference is not a Piston Gauge, **COMPASS** runs a leak test. Pressure is set to the specified leak test pressure and maintained for the leak dwell time. If an automated pressure controller is not used, prompts to set the pressure display. At the end of the leak test dwell time, pressure control is aborted in automated controllers. A 30s adiabatic delay is imposed before beginning the leak test. The starting pressure reference and DUT output is read by **COMPASS** and logged. At the end of the leak test time, the final reference and DUT output is again read by **COMPASS**. The difference in pressure divided by the leak test time determines the leak rate. If the absolute value of this leak rate is less than the Leak Rate Limit specified in the test definition, the leak test passed. Otherwise the leak test failed. Unless the **<Abort on failure>** option is checked on the **[Leak Test]** tab of the Test Definition, test execution continues regardless of the leak test results. The results of the leak test are logged to the Data File and can be viewed by clicking one of the inset panels on the status bar.

❸ **Run Pressure Exercise:** If pressure exercise cycles are specified in the Test Definition, exercising occurs now. Pressure is set to the cycle **<Min pressure>** followed by the cycle **<Max pressure>** then vented for the number of times specified in the test file. If the pressure is being set manually, consider that there is no reason to set the pressure precisely. If cycling fails due to a cycle set pressure timeout on an automated pressure controller and **<Abort test on failure>** for cycling is checked in the Test Definition, the test aborts. Otherwise, test execution continues. Use the **[Next]** icon to skip the pressure exercise if desired.

❹ **Set Test Temperature:** If a test temperature sequence is defined in the Test Definition, the test temperature is set. Prior to setting the temperature any pre point macro or valve driver change specified in the Test Definition is set before setting the temperature. The active temperature controller is set to the target temperature or a user prompt to set the temperature manually displays. The active temperature controller is selected during Test Initialization. Regardless of the controller specified in the actual Test Definition, the controller selected during Test Initialization is used.

- **Regulation:** When temperature regulation is active in the Test Definition and the temperature reference has a remote interface, the target temperature is adjusted based on the output of the temperature reference at intervals specified by the Test Definition. Regulation is explained in greater detain in section 3.3.5.1.

- **Stability Test:** After the Temperature is set using an automated controller, the test stability criteria are used to determine when the temperature is ready. A controller is ready because the remote response from the controller's Ready Command returns true or the temperature reference output is within the hold limit and the output is stable within the stability limit. Stability and hold criteria are used only when an automated temperature reference is used.

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- **Jog before dwell:** If jog mode is selected in the Test Definition, the Output Control window displays with only the Target Temperature and **<Jog>** buttons active. Use these control functions in the necessary combination to set the desired output. The jog feature is rarely used for temperature control.

- **Dwell:** If timed dwell is specified in the Test Definition, the dwell time counts down and execution continues. If the Test Definition specifies manual dwell, **COMPASS** waits for the operator to press **[OK]** on the Dwell Complete dialog box before test execution continues.

❻ **Set Test Line Pressure:** If a test line pressure sequence is defined in the Test Definition, the test line pressure is set. Prior to setting the line pressure any pre point macro or valve driver change specified in the Test Definition is set before setting the pressure. The active line pressure controller is set to the target pressure or a user prompt to set the pressure manually displays. The active line pressure controller is selected during Test Initialization. Regardless of the controller specified in the actual Test Definition, the controller selected during Test Initialization is used.

- **Regulation:** When line pressure regulation is active in the Test Definition and the line pressure reference has a remote interface, the target line pressure is adjusted based on the output of the line pressure reference at intervals specified by the Test Definition. Regulation is explained in greater detain in section 3.3.5.1.

- **Stability Test:** After the line pressure is set using an automated controller, the test stability criteria are used to determine when the line pressure is ready. A controller is ready because the remote response from the controller's Ready Command returns true or the line pressure reference outputs a pressure that is within the hold limit relative to the target and the output is stable within the stability limit. Stability and hold criteria are used only when an automated line pressure reference is used.

- **Jog before dwell:** If jog mode is selected in the Test Definition, the Output Control window displays with only the Target Temperature and **<Jog>** buttons active. Use these control functions in the necessary combination to set the desired output.

- **Dwell:** If timed dwell is specified in the Test Definition, the dwell time counts down and execution continues. If the Test Definition specifies manual dwell, **COMPASS** waits for the operator to press **[OK]** on the Dwell Complete dialog box before test execution continues.

❼ **Set Test Pressure:** Prior to setting the test pressure any pre point macro or valve driver change specified in the Test Definition is set before setting the pressure. The active pressure controller is set to the target pressure or a user prompt to set the pressure manually displays. The active pressure controller is selected during Test Initialization. Regardless of the controller specified in the actual Test Definition, the controller selected during Test Initialization is used.

- **NON DHI Piston Gauge Reference:** When the pressure reference is a piston gauge, the Piston Gauge Calculator is used as a run screen. To set a pressure, **COMPASS** automatically displays this form with the target pressure entered. Load the selected masses and float the piston to set the target pressure. After the piston is floating and stable, press the **[Pressure is Ready]** button to proceed with the test dwell. Piston gauges do not support jog or regulation features.

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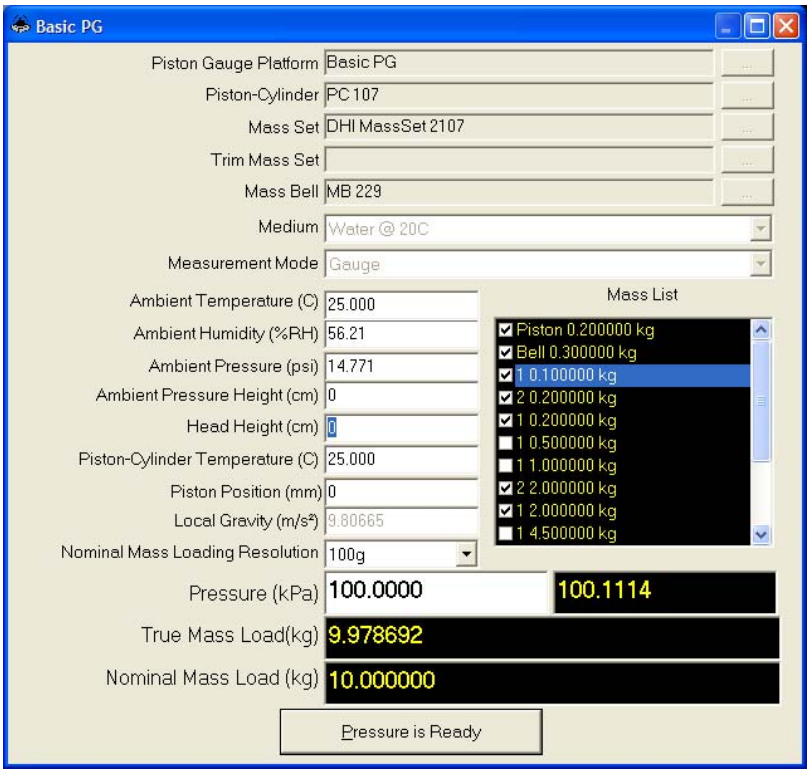

Figure 91. Set Pressure with Non **DHI** Piston Gauge

- **DHI Piston Gauge Reference:** When the pressure reference is a **DHI** PG7000 setup with the **<Auto Detect Setup>** option, a prompt with the required nominal mass load is presented. Load this mass according to the PG's mass loading order and press **[OK]**. A second prompt to generate the test pressure and float the piston is displayed. Float the piston and press **[OK]**. When automatic pressure generation is enabled in the Test Definition, the second prompt is skipped. Test execution proceeds to directly to dwell after the pressure is set. Piston gauges do not support jog or regulation features.

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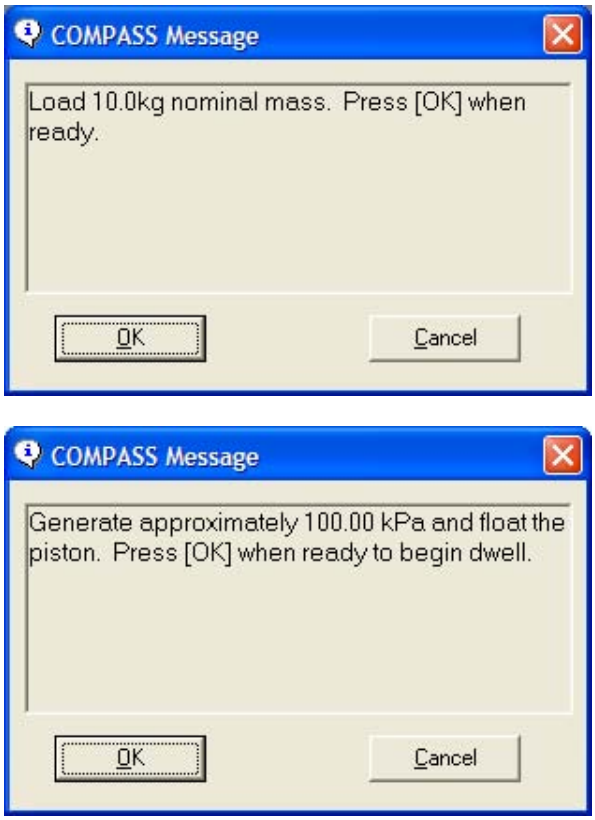

Figure 92. Set Pressure with a **DHI** Piston Gauge

- **Regulation:** When pressure regulation is active in the Test Definition and the pressure reference has a remote interface, the target pressure is adjusted based on the output of the pressure reference at intervals specified by the Test Definition. Regulation is explained in greater detain in section 3.3.5.1.

- **Stability Test:** After the test pressure is set using an automated controller, the test stability criteria are used to determine when the test pressure is ready. A controller is ready because the remote response from the controller's Ready Command returns true or the test pressure reference outputs a pressure that is within the hold limit relative to the target and the output is stable within the stability limit. Stability and hold criteria are used only when an automated pressure reference is used.

- **Jog before dwell:** If jog mode is selected in the Test Definition, the **Output Control** window displays with only the Target Temperature and **<Jog>** buttons active. Use these control functions in the necessary combination to set the desired output. Pressure jogging is typically used to set cardinal pressures on DUTs.

- **Dwell:** If timed dwell is specified in the Test Definition, the dwell time counts down and execution continues. If the Test Definition specifies manual dwell, **COMPASS** waits for the operator to press **[OK]** on the Dwell Complete dialog box before test execution continues.

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❽ **Take data:** Following the settings in the Test Definition **[Data]** tab, all test instruments are read as many times as possible for the averaging period. If timed averaging is specified in the Test Definition, the averaging time counts down as the data is averaged. If manual averaging is selected, a message displays awaiting confirmation of when to start averaging. A fixed averaging time can be entered in this window if desired. If the fixed time is entered and the **<Fixed Average>** button is pressed, the averaging process continues just as though a fixed time were specified in the Test Definition. If the manual average is used, a new message displays awaiting confirmation of when to end averaging. The elapsed time displays on the window until the average is ended. Averaging occurs only for instruments that can be read automatically. At the completion of test averaging, the manual entry window displays when manual entry devices are used in the test.

- If this is the last point in a pressure cycle, the **[Tools]**, **[Options]**, **[End Test]** tab last point selection is used to determine what to do after the last point. During all other test points, pressing the **<Step Back>** run toolbar option allows points to be repeated by stepping back through the point sequence. Since a new cycle begins or the test ends immediately following the last point, this special option is used to allow the user to repeat a point at the end of a test.

- After all data is collected test execution continues with the setting of the next test pressure target, (Step 6). This process is repeated for all test pressure points for each **<Pressure Cycle>** defined in Test Definition.

- After each pressure point and pressure cycle are complete, test execution resumes with the next line pressure target (Step 5).

- After each line pressure is complete, test execution resumes with the next test temperature target (Step 4).

❾ When multiple **<Complete Test Cycles>** are used test execution continues with the first test temperature point (Step 4). Leak tests and pressure exercise are not repeated in multiple test cycles.

7.4.1 TEST CONCLUSION

After run test is complete (see Section 7.3.4), test conclusion begins. Other than the repeat point option, there are two main steps to the test conclusion.

❶ **Test Notes:** The **<Test Notes>** pop-up appears to allow the user to enter notes concerning the test run that has just completed. The notes are included in the Data File and can be used in reports. In multi-cycle tests, only one display for the test notes occurs. The test notes step can be skipped by selection in the **[Tools]**, **[Options]**, **[End Test]** tab.

❷ **Test Complete Screen:** If the auto generate report option is selected on the **[Tools]**, **[Options]**, **[End Test]** tab, the current report template is used to generate a report with the test Data File. Regardless of this selection, the Test Complete screen displays with the name and path of all test Data Files and offers various post test options. Data Files are listed even when the data is automatically added to the **COMPASS** Test Data Database (see 24.2, [Database], [Setup]). Check the Data File(s) then press the button to execute the desired feature. Operation always returns to the Test Complete screen until Exit Test is selected.

Table 33 lists the Test Complete options.

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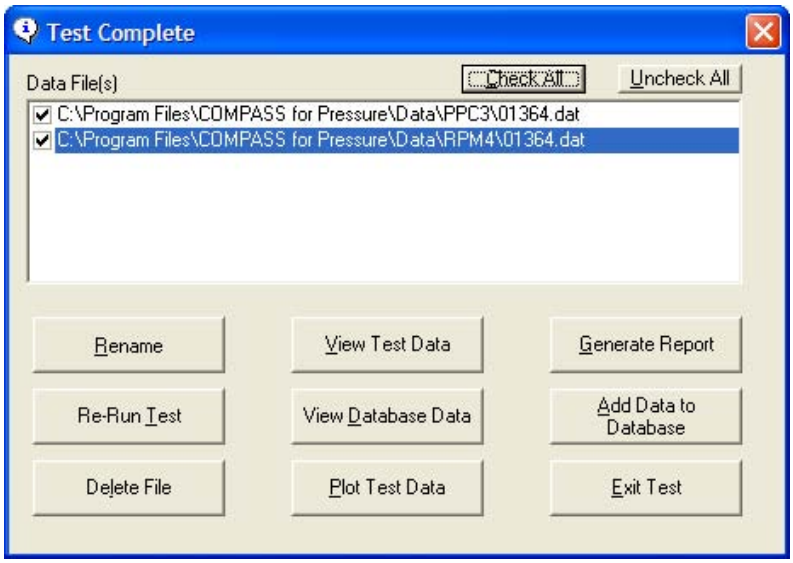

Figure 93. <Test Complete> Panel

Table 33. <Test Complete> Panel Options

FEATURE	DESCRIPTION
[Rename] (action button)	Used to override the default name and directory for the Data File resulting from the test. Brings up a standard Windows Save As file box showing the default directory and file name. These can be rewritten, if desired.
[View Test Data] (action button)	Used to review raw test data immediately following test completion without exiting the test completely. This selection causes the Data File viewer to appear with the *.dat file from the test that has just completed open. This is functionally equivalent to selecting **[Data], [View Data File]** with the Data File from the test that has just completed (see 19, [Data], [View Data File]). Close the Data File viewer using the control box **<X>** or press **<Esc>** to return to the **Test Complete** selections.
[Generate Report] (action button)	Used as a shortcut to generate a test report immediately following test completion. The **COMPASS** Report Editor merges the Data File with the last used report template to generate a report. Multiple individual reports can automatically be created with the selected template if the proper report Editor options are selected. The report Editor displays each report generated. This is functionally equivalent to running the **COMPASS** Report Editor as a standalone application and selecting the **[File], [Generate Report]** option (see 23, [Data], [Report Editor]).
[Re-Run Test] (action button)	Used to re-run the exact same test under the exact same conditions without initialization prompts or selections. This feature does not overwrite the current Data File(s), it creates a new Data File for each DUT.
[View Database Data] (action button)	Used to review database data immediately following test completion without exiting the test completely. This selection causes the **COMPASS Data Viewer** form to appear with the first selected data file loaded. This option is available only when the data file was automatically added to the test base at the end of the test (see 24.2, [Database], [Setup]) or when the **[Add Data to Database]** button is pressed. This is functionally equivalent to selecting **[Data], [Database Data Viewer]** option and viewing the Data File from the test that has just completed. Close the **COMPASS Data Viewer** using the control box **<X>** or press **<Esc>** to return to the **Test Complete** selections.
[Add Data File to Database] (action button)	This feature is not enabled when the Data File is automatically added to the **COMPASS** Test Data Database at the end of a test (see 24.2, [Database], [Setup]). Press this button to add the selected Data Files to the **COMPASS** Test Data Database. This is functionally equivalent to selecting **[Data], [Write Data File to Database]** option and selecting the Data File from the test that has just completed. Close the **COMPASS Data Viewer** using the control box **<X>** or press **<Esc>** to return to the Test Complete selections.
[Delete File] (action button)	Used to delete the selected Data File(s). Use this feature if the data taken will not be used. When used, a delete confirmation prompt must be answered prior to deleting the Data File. When confirmed, the file is deleted and the Test Complete window automatically closes.

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FEATURE	DESCRIPTION
[Plot Test Data] (action button)	Used as a shortcut to immediately view plots using the data from the test that just completed. This choice is functionally equivalent to exiting the test and selecting **[Data], [Plot Data File]** (see 20). Close the plot function using the control box **<X>** or press **<Esc>** to return to the **Test Complete** selections.
[Exit Test] (action button)	Exits the test. The **Test Complete** pop-up disappears and the main menu and associated screen reappear. The current test data remains active until another test is started.

7.5 [RUN], [RUN MANUAL TEST]

Use this feature to manually select testing devices and execute a test without a Test Definition. This run mode is useful for running devices without following a predefined test sequence. Although, data acquisition is supported, it is not a required part of a manual test. During the test initialization process, the last Manual Test selections display. These selections can be changed if desired. There are no requirements to use any specific combination of devices. For example, a Manual Test can be executed using a temperature controller only. Manual Tests should be used for trouble shooting device final output setups and running specialized tests. Run a Manual Test to verify that a device is working properly with **COMPASS** or to log "drift" data of a device over time.

To run a Manual Test, the Test Initialization is required. The only difference between the initialization of a Manual Test and a Test Definition is that there is no Test Definition selection step. After initialization, all remote devices are automatically polled by **COMPASS** and output information is displayed on their respective run screens. Use the features on the Data Acquisition section of the Main Toolbar to create a Data File and log test points. Use features on the Test Conditions Run Screen as well as the individual run screens of the testing devices to change the state of any test controllers.

Using any of the Control Toolbar automatic data logging options can result in very large Data Files. These are files with significantly greater than 1 000 data points. COMPASS is not intended to manipulate such files. Lower performance PC's will experience significant delays in generating reports and plots of very large Data Files. Therefore, it is not recommended to use COMPASS plotting and reporting functions with very large Data Files. Instead, export the Data File to a spreadsheet application for further analysis.

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8. [SETUP], [TEST]

8.1 OVERVIEW

Test Definitions are used to define a specific test procedure including the sequence of test points and a large number of operational details. DUT(s) to be tested and a Test Definition are selected during the initialization of **COMPASS, [Run Test Definition]** mode. A pointer to a default Test Definition for a DUT is included in the DUT Definition, **[Calibration]** tab.

8.2 TEST EDITOR

Create, edit and remove Test Definitions using the Test Editor. Access this feature using **[Setup], [Test]** or the Main Toolbar, **[Edit Test]** icon (see 5.4.2, Run Display Tools). When the Test Editor is opened, the last accessed Test Definition is displayed. While in the Editor, use the Editor Toolbar options to create, edit, view and delete tests.

The **Test Editor** uses the same editing concepts as the DUT Editor. Only one Test Definition can be edited at a time. The test scroll bar and the Test Selector are available to make new test selections. A flashing indicator displays when a Test Definition is modified or a new definition is created.

Different types of Test Definitions are supported depending of the version of **COMPASS** installed. Use the **<Test Definition Type>** option to select the type of test. The choices are:

- **Simple Test** – Basic test that defines a list of pressure points only. No macro or changes in reference device during the test are permitted.
- **Simple Test w/Temperature** - Pressure and Temperature points are definable. No macro or changes in reference device during the test are permitted.
- **Simple Test w/Temperature and Line Pressure** - Pressure, Temperature and Line Pressure points are definable. No macro or changes in reference device during the test are permitted.
- **Advanced Test** – All test point types are definable. In addition Test Macros and reference changes can be used to test a device (available in **COMPASS for Pressure**, Enhanced only).

Section 7.4 **(**Run Test**)** explains the standard **COMPASS** algorithm for running tests. Familiarity with the steps of test execution steps is necessary to properly setup a Test Definition. Refer to the following sections for details on the selections in the Test Editor.

Test Definitions can only be edited when COMPASS is not in an active run mode. If in [Run Test] mode, only the active Test Definition displays. All fields and selection functions in the editor are disabled.

8.3 CREATING TEST DEFINITIONS

Open the Test Editor using the **[Setup], [Test]** menu option. Use the **Test Toolbar**, **[New]** icon to create a new Test Definition. Set up the test as desired then press the **[Save]** icon to store the test information. Any conflicts that exist will cause an error message to display. Resolve the conflicts before re-saving. The **[Restore]** icon is nonfunctional for new tests. The feature only restores to the last saved state. Since new Test Definitions have not been saved, there is nothing to restore.

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Familiarity with test execution sequence is necessary for proper setup of a Test Definition. Review the Run Test Sequence section of this manual (see 7.4, Run Test).

If a Test Definition similar to the one to be created exists, use the [Copy] toolbar icon to copy the existing Test Definition into a new Test Definition with the same characteristics. Then make the edits specific to the new test. Don't forget to change the <Record Label> prior to saving.

8.4 EDITING TEST DEFINITIONS

Tests can be edited whenever **COMPASS** is not in an active run mode. Use the **[Setup], [Test]** menu option to display the Test Editor if it is not already open. Simply changing information in the Test Editor places the Editor in the edit mode. No specific option need be selected to begin editing a Test Definition. Use the **[Save]** icon to store the edits or press the **[Restore]** icon to return the test to its original state.

8.5 [PRE-TEST] TAB

The Test Editor, **[Pre-Test]** tab defines Leak Test and Pressure Exercise settings. When enabled, these operations occur at the beginning of a test. Advanced Tests support a Pre-Test Macro to use before the leak or pressure cycle tests begin.

Familiarity with Run Test Sequence section of this manual is useful when modifying a Test Definition (see 7.4, Run Test).

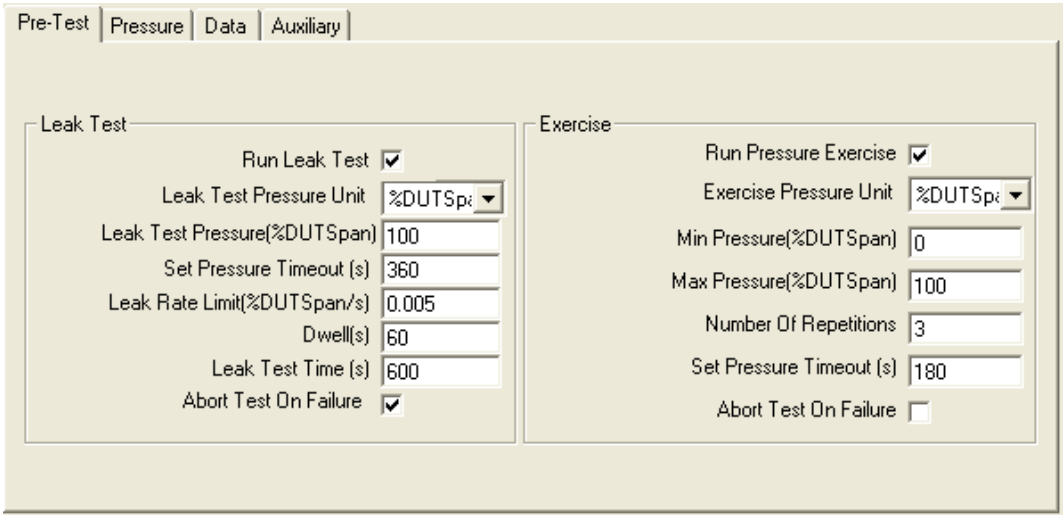

Figure 94. Test Editor, **[Pre-Test]** Tab

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8.5.1 PRE-TEST MACRO

A Pre-Test Macro is available in Advanced Test Definitions only. Use the **COMPASS** Macro Editor to define a Pre-Test Macro that handles test specific operations (see 18.5.8, Test Macros). The macro can be used to set a specific valve state or purge test devices prior to running a test. Instrument data can be queried within the macro and stored in the calibration fields of a Device Class so that the data is logged to the data file (see 28.5, Device Class). No data is collected nor are any test based decisions made as a result of the outcome of the macro. The code within the macro however, can alter the test if desired.

8.5.2 LEAK TEST FRAME

The Test Definition Editor, **[Pre-Test]** tab, **[Leak Test]** frame is used to specify whether a leak test will be run at the beginning of a test and to define the leak test parameters.

The leak test, if included, occurs at the very start of test execution. Pressure is set to the specified **<Leak Test Pressure>** and pressure control is aborted once a *Ready* condition is reached. If the pressure controller does not support Abort commands, a prompt to abort pressure control is given to the user. **COMPASS** then allows pressure to stabilize for the **<Dwell Time>**. Once the dwell time has completed, pressure is measured over the **<Leak Test Time>**. Then the pressure is vented. The leak rate is calculated as the difference in pressure between the beginning and end of the **<Leak Test Time>**, divided by the leak test time. The leak test pass/fail is determined by comparing this value to the **<Leak Rate Limit>**. The **<Abort Test On Failure>** option determines whether the test proceeds if the leak test fails. If the test proceeds, the pass/fail status of the leak test is indicated in the **[Leak Test]** section of the Data File.

When running a test, the [Skip Forward] toolbar icon can be used to skip the leak test. This may be desired if a Test Definition that includes a leak test is aborted at some point after the leak test is complete, and then the test is immediately repeated.

The purpose of the **[Leak Test]** tab's fields and settings as well as instructions on how to use them are provided in the table below.

Table 34. Test Editor, **[Pre-Test]** Tab, **<Leak Test>** Fields

FIELD	DESCRIPTION
Run Leak Test (check box selection)	Determines whether a leak test will be run at the beginning of a test or not. If the option is checked, a leak test will be run. Otherwise, a leak test will not be run and the rest of the **<Leak Test>** panel is disabled.
Leak Test Pressure Unit (list box)	The unit of measure in which the leak test pressure is defined. The selected unit in this field is appended to the unit specific fields of the Leak Test setup. Numerous pressure units and %DUTSpan are amongst the available unit choices. If %DUTspan is used, leak values entered are converted to a pressure based on the span of the first DUT tested.
Leak Check Pressure (aaaaaaaa) (numeric entry field)	Defines the pressure at which the leak test will be run in the unit of measure **(aaaaaaa)** specified in **<Leak Test Pressure Unit>**.
Set Pressure Timeout(s) (numeric entry field)	Defines the amount of time in seconds for which automated pressure control will try to set the leak check pressure before a timeout occurs. If the controller is unable to set the leak test pressure within the timeout period, the leak test is aborted. When setting the pressure, the criteria used to determine if the pressure has been set are the same as those used when setting pressure for any other test point. Whether the test will continue on timeout is determined by the **<Abort Test On Failure>** setting (see below in this table). If pressure control is **<Manual>**, the leak test set pressure timeout is ignored.

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FIELD	DESCRIPTION
Leak Rate Limit (aaaaaaa/s) (numeric entry field)	Defines the leak test pass/fail criterion in pressure unit **(aaaaaaa)**/second. The pressure unit is the **<Leak Test Pressure Unit>**. The leak rate is calculated in pressure unit per second following: total pressure change during the leak test time divided by the leak test time in seconds. If the absolute value of the calculated leak rate is greater than the **<Leak Rate Limit>**, the leak test fails.
Dwell (numeric entry field)	Specifies the amount of time to wait after the pressure has been set before aborting pressure control and starting the leak test measurements. A dwell delay improves the reliability of the leak test by allowing adiabatic effects to settle out prior to beginning the actual leak test.
Leak Test Time (numeric entry field)	Defines the amount of time over which the leak testing pressure measurement is made. The appropriate amount of time depends on the characteristics of the test system and the leak rate limit. When setting the leak test time, keep in mind that immediately after setting the leak test pressure, the dissipation of adiabatic temperature changes and settling time of the test volume will give the appearance of a leak. For this reason **<Dwell>** time should be used to allow these effects to dissipate. Typical leak test times are from a minimum of about 30 seconds to a maximum of about 5 minutes.
<Abort Test On Failure (check box selection)	The selection determines whether test execution will continue if the leak test fails (i.e., a set pressure timeout occurs or the leak rate limit is exceeded). If the option is not checked, the test will continue if the leak test fails and the failure will be indicated in the test Data File. Otherwise, the test will abort. This option is sometimes disabled when running fully automated, unattended tests to attempt to complete the test and gather test data even though the leak test failed. Of course, if the leak is too large, the test may yield invalid test data.

8.5.3 EXERCISE FRAME

The **[Exercise]** frame is used to specify whether the DUT and test system will be pressure exercised at the beginning a test and to define the exercising parameters. Exercising occurs immediately following the leak test (if included) and just before the test points begin. Pressure is set to the **<Min Pressure>** immediately followed by the **<Max Pressure>** entry for the number of cycles selected. After the cycles, a vent is executed.

The Exercise function, which is used to exercise the system before running test points, should not be confused with the <Pressure Cycles> option on the [Pressure] tab which determines how many times the complete test pressure points sequence will be run.

Running two or three full scale pressure cycles prior to the test is recommended for DHI products.

The exercising sequence is: set pressure to the cycle minimum, set pressure to the cycle maximum, set pressure back to the minimum, repeat for the number of cycles that are specified, vent system. No measurement data is recorded during cycling.

When running a test, the [Skip Forward] toolbar option can be used to skip pressure exercising. This may be desired if a Test Definition that includes pressure exercising is aborted at some point after the exercising, and then the test is immediately restarted.

The purpose of the **<Exercise>** panel's fields and settings as well as instructions on how to use them are provided in the table below.

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Table 35. <Test Editor>, [Pre-Test] Tab, Exercise Frame Fields

FEATURE	DESCRIPTION
Run Pressure Exercise (check box selection)	Determines whether pressure exercising will be conducted at the beginning of the test or not. If checked, exercising will occur at the beginning of the first test cycle. Otherwise, exercising will not occur and the rest of the **<Cycle>** panel is disabled.
Exercise Pressure Unit (list box)	The unit of measure in which the exercise pressures are defined. The selected unit in this field is appended to the unit specific fields of the exercise setup. Numerous pressure units and %DUTSpan are amongst the available unit choices. If %DUTspan is selected, cycle pressure values entered are converted to a pressure based on the span of the first DUT when the test is run.
<Min Pressure (aaaaaaaa)> (numeric entry field)	Defines the minimum exercising pressure to be set for each exercise cycle. **(aaaaaaa)** is the **<Exercise Pressure Unit>** choice. To make the minimum pressure "VENT" or the lowest value that can be set by a piston gauge, place the cursor in the field and then press the computer's **[Insert]** key to call a dropdown list with these insert selections.
<Max Pressure (aaaaaaaa)> (numeric entry field)	Defines the maximum exercising pressure to be set for each exercise cycle. **(aaaaaaa)** is the **<Exercise Pressure Unit>** choice. To make the maximum pressure "VENT" or the lowest value that can be set by a piston gauge, place the cursor in the field and then press the computer's **[Insert]** key to call a dropdown list with these insert selections.
<Number of Cycles> (numeric entry field)	Defines the number of times the minimum – maximum – minimum pressure exercising cycle will be repeated.
<Set Pressure Timeout(s)> **(numeric entry field)**	Defines the amount of time, in seconds, before a timeout will occur when an automated pressure controller is being used to set the exercise pressure. If the controller is unable to set the exercise pressure within the timeout period, cycling is aborted. When setting the pressure, the criteria used to determine if the pressure has been set are the same as for any other test point. Whether the test will abort after a set pressure timeout is determined by the **<Abort Test On Failure>** setting (see below in this table). If pressure control is **<Manual>** the cycle set pressure timeout is ignored.
<Abort Test On Failure> **(check box selection)**	The selection determines whether test execution will continue if cycling fails (a timeout occurs when setting cycle pressure). If the option is not checked, the test will continue if cycling fails. Otherwise, the test will abort when cycling fails. **<Abort Test On Failure>** is sometimes disabled when running fully automated unattended tests to attempt to complete the test and gather test data even though cycling was not successful. Of course, the conditions that caused cycling to fail may also cause the test data to be invalid.

8.6 TEST POINT SEQUENCE

8.6.1 OVERVIEW

There are three types of test point sequences: Pressure, Temperature and Line Pressure. Which are available depends on the **<Test Definition Type>**. Each test point sequence is defined on it's own tab within the **<Test Editor>**. With few exceptions, the setup of each point sequence is identical. However, each point sequence is used in a unique fashion as described in the **Run Test Sequence** section of this manual.

Familiarity with the Run Test Sequence section of this manual is useful when modifying a Test Definition (see 7.4, Run Test).

A point sequence not only defines the points to set during a test, it also specifies the reference measurement and control devices to use, settings related to how the output will be controlled, when to adjust valve driver settings and when to execute a specific **Test Macro**.

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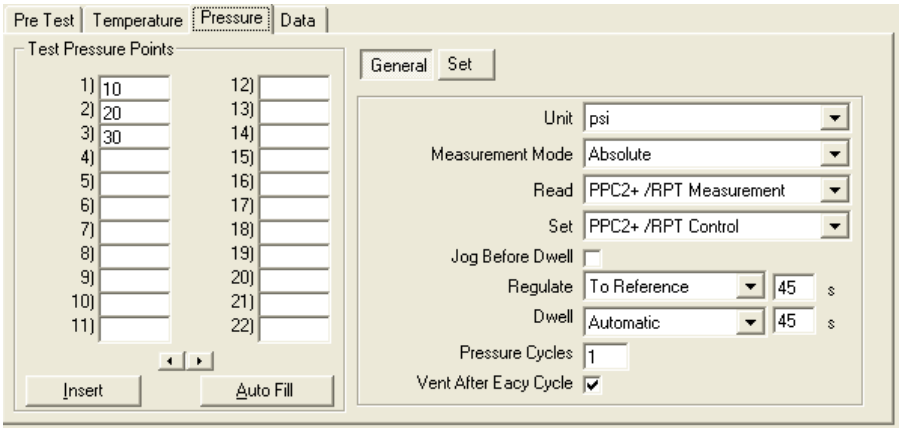

Figure 95. [Pressure] Point Sequence Tab

Each point sequence tab includes child tab buttons to categorize the specific sequence. The following sections detail the options available on the **Test Editor**, **[Temperature]**, **[Line Pressure]** and **[Pressure]** tabs.

With certain <Test Definition Type> selections, not all point sequence tabs are available (see 8.2, Test Editor).

The points table displays on the left panel of the point sequence tab. The points described are always in the **[General]** child tab, **<Unit>** selection. Temperature and Line Pressure point sequences are optional. Disable these options by choosing a different test definition type or by un-checking the **[General]** child tab **<Run Temperature (or Line Pressure) Sequence>** option.

8.6.2 TEST POINT SEQUENCE, INSERT OPTIONS

Use the **[Insert]** button, press the **{Insert}** key on the computer's keyboard or click the point number next to each point to get a list of point options. Use these features to add and remove test points as well as add special point features.

Right-click the option number next to each point to remove custom point features.

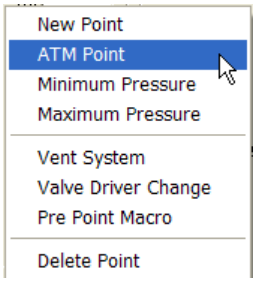

Figure 96. Insert Options

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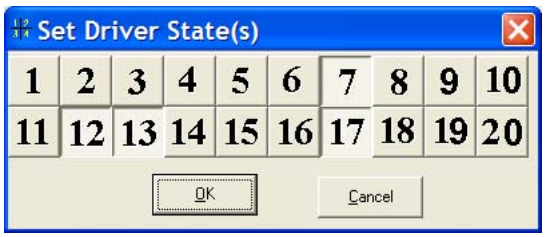
Table 36. Insert Options Choices

FEATURE	DESCRIPTION
New Point	All existing test points are shifted down to expose an empty point at the selected test point.
ATM Point "ATM"	The test point is an atmospheric measurement. The test controller is vented or the test user is prompted to vent the system. The **Vent** commands of a controller are sent when a remotely interfaced controller is used. When automated control is not available, the test operator is prompted to vent the system. For Line Pressure and Test Pressure point sequences, the equivalent pressure is the current atmospheric pressure, achieved by venting pressure and opening to atmosphere. For a temperature controller, the equivalent temperature is ambient temperature achieved by stopping temperature control. The text "**ATM**" displays in the point field when this option is selected.
Minimum "MIN"	The test target pressure is the minimum DUT pressure or the minimum pressure of the controller for pressure based point sequences. For line pressure and temperature point sequences, the minimum controller output is used as the test point. Minimum controller outputs are defined as the **<Minimum>** Set entry on the **[Final Set]** tab of the **Set Relationship Editor**. The text **<MIN>** displays in the point field when this option is selected.
Maximum "MAX"	The test target pressure is the maximum DUT pressure or the maximum pressure of the controller for test pressure based point sequences. For line pressure and temperature point sequences, the maximum controller output is used as the test point. Maximum controller outputs are defined as the **<Maximum>** Set entry on the **[Final Set]** tab of the **Set Relationship Editor**. The text **<MAX>** displays in the point field when this option is selected.
Vent System "V"	This option vents the system pressure or temperature but does not log a test point. The **Vent** commands are sent for automated controllers and the user is prompted for controllers that do not support **Vent** commands and when the controller is manual. The active controller "Ready" criterion is used to determine the system stability before considering the system "Vented". The point label will include a **<V>** when this option is selected.
Valve Driver Change "D"	This option sets a specific valve driver state prior to setting the target value of a test point. When selected, the **<Set Driver State>** form displays to allow the driver state to be set. Driver numbers that are depressed are considered ON and valve drivers that are not pressed are considered OFF. When running a test, **COMPASS** sends commands to the configured Valve Driver Controller to set the selected valve state. If a Valve Driver Controller is not configured, a warning message displays during test initialization. The point label includes a **<D>** when this option is selected. *Do not select valve driver states that exceed the ability of the valve driver controller. This can lead to remote interface timeouts and other interface based errors.* *There are no built in delays associated with changing the valve driver state. Make sure that the test hardware will not be damaged as a result of quick valve driver changes. If delays are necessary, use a COMPASS Test Macro to add delays between valve driver state changes.*  **Figure 97.** Driver State Selector

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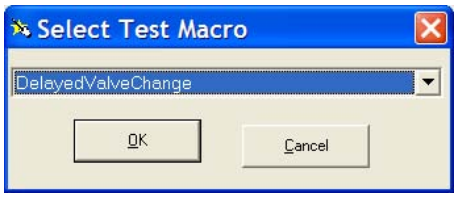
FEATURE	DESCRIPTION
Pre Point Macro "M"	This option allows the selection of a **COMPASS** Test Macro to execute prior to setting a test point. All Test Macros are listed in the **<Select Test Macro>** dialog. Select a macro from the list or choose the **[Add Macro]** option to use the **COMPASS** Macro Editor to define a new Test Macro **(**see 18.5.8, Test Macros). A **Test Macro** can perform a variety of operations in a single step. Changing valve states while monitoring the output of test devices is a common use of this feature.  **Figure 98.** Test Macro Selector
Delete Point	Deletes the selected test point. All points in the test point table are shifted up.

8.6.3 CUSTOM POINT OPERATIONS

To the left of each point is a number identifying the point and in some cases a sequence of letters. These letters describe special operations associated with the test point. These operations must take place prior to actually setting a point target. The order of these operations is fixed by **COMPASS** and described in the table below. The table lists the codes in order of their operation.

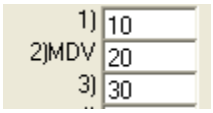


Figure 99. Custom Operation Point Labels

Table 37. Custom Operation Point Label Definitions

CODE	FUNCTION
M	A **Test Macro** will execute for the test point.
R	The pressure or temperature measurement reference will change at the test point. The reference is defined on the point sequence tab, **[Output]** child tab. This feature is only available in Advanced Test Definition Type. The reference change can use it's own Test Macro.
S	The pressure or temperature controller will change at the test point. The controller is defined on the point sequence tab, **[Set]** child. This feature is only available in Advanced Test Definitions Type. The controller change can use it's own Test Macro.
D	A valve driver state will change.
V	A system vent will execute.

Right click the label next to a test point to remove custom point features.

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8.6.4 AUTO FILL

Use the **[Auto Fill]** button on the Point Sequence tab **<Test Points>** Panel as a shortcut to entering evenly spaced or symmetrical test points. When the button is pressed, the **<Auto Fill Test Points>** form displays. Enter the **<Starting Value>** and **<Ending Value>** along with the appropriate **<Step Value>** and press the **[Fill Points]** button to automatically update the test points.

To enter a single point repeatedly, enter the value in the <Starting Value> and <Ending Value> then enter the number of times to repeat the point in the <Step Value> field.

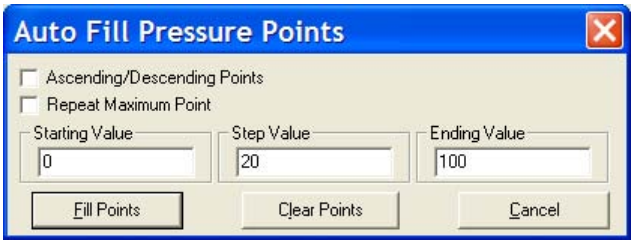

Figure 100. Auto Fill Pressure Points

Table 38. Auto Fill Points Fields

FEATURE	DESCRIPTION
Ascending/ Descending Points (check box)	Selects whether the Auto Fill point sequence will run from starting point to ending point only or from starting point to ending point and back to starting point. If checked, the test point sequence is from starting point to ending point and back to starting point. Making a selection has no effect until **[Fill Points]** is pressed.
Repeat Maximum Point (check box)	Check this option to repeat the maximum point when the **<Ascending/Descending Points>** option is used. Repeating the maximum point is used to properly weight test data when a linear regression will be applied to determine new calibration coefficients for a DUT. In many cases, the error associated with the incorrect point weighting is beyond the resolution of the device and is therefore, not necessary.
Starting Point (numeric entry field)	Defines the first point of an Auto Fill test point sequence. Entering a value in this field has no effect until **[Fill Points]** is pressed.
Ending Point (numeric entry field)	Defines the last point of an Auto Fill test point sequence. Entering a value in this field has no effect until **[Fill Points]** is pressed.
Step Value (numeric entry field)	Defines the increment used by Auto Fill to determine test points between the starting point and ending point. Entering a value in this field has no effect until **[Fill Points]** is pressed.
Fill Points (action button)	Clicking **[Fill Points]** causes the test point table to clear and fills in the table with the points calculated from the Auto Fill instructions (**<Starting Point>**, **<Ending Point>**, **<Step Value>**, **<Ascending/Descending Points>**). If the values are such that the distance from starting point to ending point is not an even multiple of the step value, the last step value is adjusted to end exactly on the ending point. Points set up by Auto Fill can be edited directly in the **<Test Points>** table and new points can be inserted at any point using the **<Test Points>** table **[Insert]** button.
Clear Points (action button)	Clicking **[Clear Points]** at any time causes all entries in the test point table to clear.

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8.6.5 TEST POINTS SEQUENCE, [GENERAL] CHILD TAB

The Test Definition Point Sequence tab, **[General]** child tab is used to specify details relating to reference and control information for test points. This includes defining point unit of measure, dwell time and output control features. The **[General]** child tab is common for Test Pressure, Temperature Line Pressure and Point Sequence Tabs. Most, but not all, features are the same on the three versions.

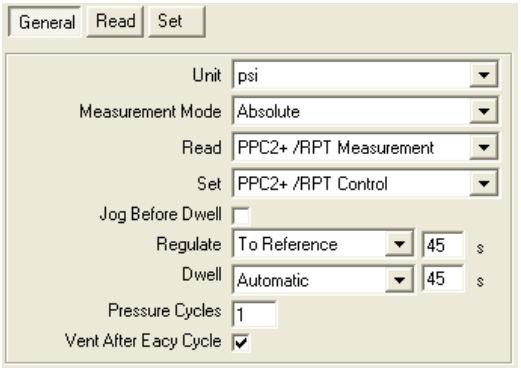

Figure 101. Test Definition Editor, Point Sequence Tab, **[General]** Child Tab

Table 39. Test Definition Editor, Point Sequence Tab, **[General]** Child Tab Fields

FEATURE	DESCRIPTION
Run Temperature Sequence or **Run Line Pressure Sequence** (condition check box)	Check this option to run the Temperature or Line Pressure sequence when the test is run. When this button is not checked, all features on the **[Temperature]** or **[Line Pressure]** tab are disabled, This choice is not present on the **[Pressure]** tab, **[General]** child tab as the pressure sequence is always run.
Unit (required list box selection)	Select the unit of measure in which the points on the Points Table are expressed. The choices include all points available in the Unit of Measure Converter. Pressure Point Sequences can use %DUTSpan as the unit. In this case, the actual test pressure unit is the **<Final Output Unit>** of the first DUT selected when the test is run.
Measurement Mode (required list box selection)	Select the pressure measurement mode in which the test points are expressed. Only pressure controlling and measuring devices that support the selected measurement mode are available in the in the **<Read>** and **<Set>** lists. Temperature point sequences do not use this selection.
Read (required list box selection)	A list of all support devices appropriate for the selected point sequence and **<Measurement Mode>** (see 3.3, Device (instrument) Support Concept). Select the item to use as the source of reference values for the given point sequence. The different point sequences use support devices that have the Final Output selections described below: **Test Pressure** Lists support devices that have Final Output of Reference Pressure and General Pressure. **Line Pressure** Lists support devices that have Final Output of Line Pressure and General Pressure. **Temperature** Lists support devices that have Final Output of **T**est Temperature and General Temperature. For Advanced Test Definitions, the option selected in this field is always assumed to be the first reference if there are multiple references. The **[Output]** child tab species all references and indicates the order in which they are used.

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FEATURE	DESCRIPTION
Set (required list box selection)	A list of all support devices appropriate to provide control for the selected point sequence and **<Measurement Mode>**. Select the device to use as the controller for the particular point sequence. The different point sequences use support devices that have the Final Set selections described below: **Test Pressure** Lists support devices that have Final Set of Test Pressure Control and General Pressure Control. **Line Pressure** Lists support devices that have Final Set of Line Pressure Control and General Pressure Control. **Temperature** Lists support devices that have Final Set **of Temperature Control.** The control settings associated with the controller are specified on the Point Sequence Tab, **[Set]** child tab. For Advanced Test Definitions, the option selected in this field is always assumed to be the first controller if there are multiple controllers. The **[Set]** child tab species all controllers and indicates the order in which they are used and their control settings.
Jog Before Dwell (check box)	If this is checked, when the test is run, test execution pauses just before the dwell phase of the test point to allow the target to be adjusted before completing the point. If the controller is automated, adjustments are made using the **<Jog Control>** form. This feature is most often used to adjust test pressure to the DUT indicated cardinal point when testing a visual output DUT such as an analog pressure gauge. **<Jog Before Dwell>** has no affect when the controller is manual.
Regulate (list box selection)	This feature is used to specify to what device's reading the target should be adjusted when an automated controller and reference are used in the test. The **<Regulate>** feature is ignored when either the Read or Set device does not include automated measurement and control (see 3.3.5.1, Regulation). The choices are: **None** **COMPASS** calculates and sends the command for the target output to the controller and makes no further adjustments. In this case, how close the final value of a point is to the target value depends on the calibration of the controlling device. Check **<Jog before dwell>** if you want to adjust the output at the point, for example to put the DUT reading on a cardinal point. **To Reference** At each point in the test, **COMPASS** continuously readjusts the set point command to the controller to adjust the output to the target value **as indicated by the reference**. This option causes the final reference value at a test point to be very close to the cardinal target point as indicated by the **<Read>** reference. **To DUT** At each point in the test, **COMPASS** continuously readjusts the set point command to the controller to adjust to the target value **as indicated by the DUT.** This option causes the final value at a test point to be very close to the cardinal point as indicated by the DUT. This feature is valid only when the DUT has automated data acquisition. The Regulation Delay entry determines the time, in seconds, between regulation loop cycles. This is how often the set point is readjusted to get closer to the target value. Setting this value to a time value that is too short relative to the response time of the system results in unstable control. Review the **Output Control** section of this manual for more details on output regulation.
Dwell (required entry field and drop down list selection)	Dwell is a pause that occurs following setting and prior to taking averaged test data at each point. When **<Dwell>** is set to **<Timed>**, **COMPASS** dwells at each test point for the specified **<Dwell Time>**, 0 – 999s. When **<Dwell>** is set to **<Manual>**, **COMPASS** dwells at each test point until **[OK]** is clicked on the **<Continue Test>** pop-up. This feature can be used to synchronize readings or to pause operation when setting a test point. *Enter a Dwell time of 0s to effectively skip the test dwell.*
Number of Test Cycles (required entry field for pressure sequences only)	**COMPASS** can run up to 10 test pressure cycles in one test. A test cycle includes setting and taking data at each of the pressure points in the **<Points>** table. When more than one test cycle is specified, pre-test operations occur only at the beginning of the first cycle. Data from multiple cycles is included in a single Data File. The test pressure cycles are repeated at each temperature, at each line pressure if there are multiple temperatures and/or line pressures.

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FEATURE	DESCRIPTION
Vent After Each Cycle (check box selection for pressure sequences only)	Check this option to vent the test pressure at the end of each test pressure point sequence. This is typically desired when running a temperature and pressure test. When setting each test temperature, the test pressure will be vented. All automated controllers that include Vent commands are vented at the end of tests regardless of this choice (see 4.4.3.1, Abort/Vent Commands).

8.6.6 TEST POINTS SEQUENCE, [READ] CHILD TAB

The Test Definition Point Sequence **[Read]** button tab is used to specify references in multi-reference tests. Only Advanced Test Definition Type tests support this option. The point that the reference change will take place and the macro associated with the reference change are updated on the right side of the tab. Use the **[Add]**, **[Remove]** and **[Edit]** buttons to change a reference, remove a reference or edit the reference settings (see **Figure 102**).

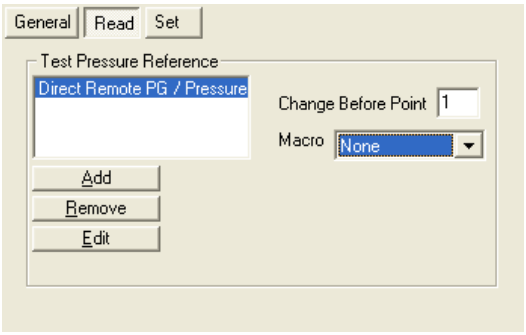

Figure 102. Test Definition Editor, Point Sequence Tab, **[Read]** Child Tab

When the **[Add]** or **[Edit]** buttons are pressed, the **Configure Device** dialogue displays (see **Figure 103**). Use this form to select a specific reference, enter the test point for the reference and select or edit a macro to execute before using the reference. Press the **[Configure Device]** button to completely configure the reference.

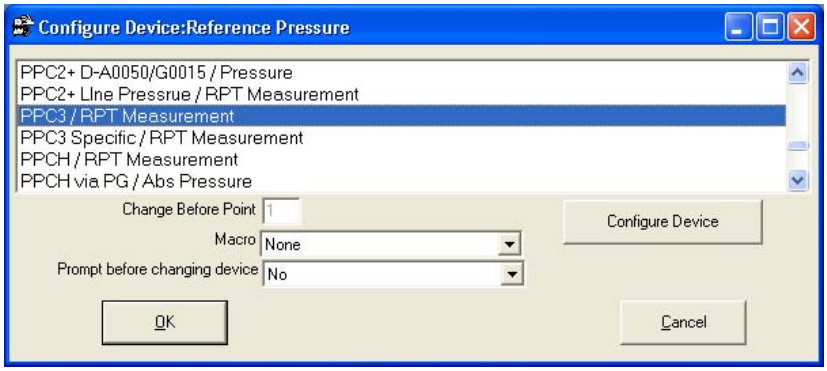

Figure 103. Configure Device Dialogue

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Table 40. Configure Device Dialogue Fields

FEATURE	DESCRIPTION
Change Before Point (conditional numeric entry)	Indicates the point at which the new reference will be used. If there is a macro selected, the macro will execute prior to changing to the new reference. The test point entered must already be defined in the **<Points>** table.
Macro (Optional list box selection)	Select a **Test Macro** to execute prior to changing the reference (see 18.5.8). Use this option to automate any reference specific operations prior to changing reference devices in a test. The active valve driver controller as well as any other test instrument can be accessed within the macro if desired.
Prompt before changing device (optional list box selection)	Select **[Yes]** to get a prompt prior to changing the reference during a test. The prompt should be used to allow the test operator to adjust any valves or make any other reference specific changes before changing the reference within the a test.
Configure Device (required list box selection)	Specify the exact range, measurement mode and remote settings of a device if desired. All options available in the device configuration step of test initialization are provided (see 7.3.3) to configure a device. The selections made allow a test operator to completely customize settings within the Test Definition.

8.6.7 TEST POINTS SEQUENCE, [SET] CHILD TAB

The Test Definition Point Sequence Tab, **[Set]** child tab is used to specify control settings for the selected test controller. The control settings are ignored when the test controller is manual. Automated tests controllers and Piston Gauge pressure control use slightly different settings. Review the Ready/Not Ready Section of this manual for details on set ready conditions in **COMPASS**.

When defining an advanced Test Definition, multiple test controllers can be specified. The form changes to be similar to the **[Read]** child tab (see 8.6.6). Features are provided to add, remove and edit controllers (see **Figure 105**). Each controller has a unique set of control options.

The purpose of the **[Set]** tab's fields and settings as well as instructions on how to use them are provided in the table below.

When using a PG7000 piston gauge as the reference, a different [Set] child tab is used. (see Table 42).

The <Use Ready Criterion> option is available for DHI products and devices that include Ready Commands (see 4.4.2.1, Ready Commands) as part of the set definition.

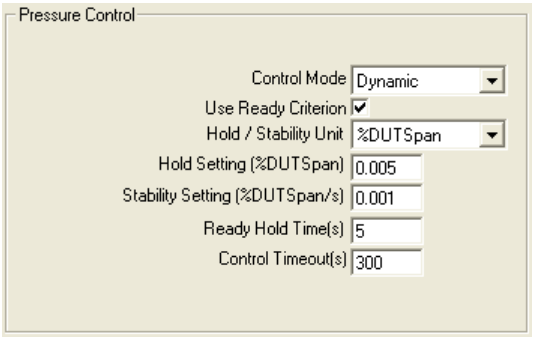

Figure 104. Test Definition Editor, **[Set]** Child Tab for a Pressure Controller

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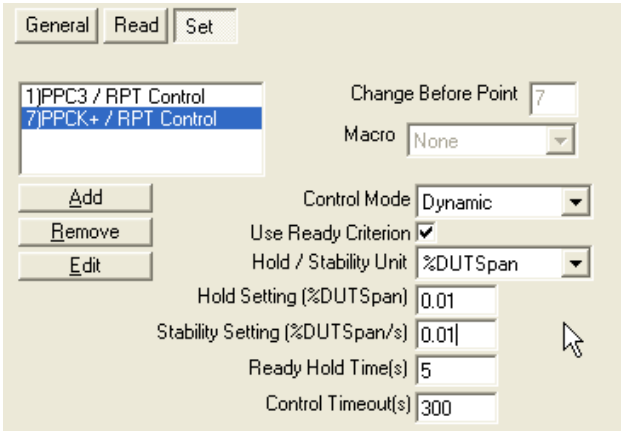

Figure 105. Test Definition Editor, Advanced Test **[Set]** Child Tab for a Pressure Controller

Table 41. Test Definition Editor, Points Sequence Tab, **[Set]** Child Tab for Pressure Controller Fields

FEATURE	DESCRIPTION
Control Mode (list box selection)	Determines how pressure will be controlled when a **DHI** PPCx Pressure Controller/Calibrator is the selected pressure controller. If the pressure controller is not a PPCx, this option is disabled (see the PPCx Operation and Maintenance Manual for additional information on dynamic and static pressure control modes). **Dynamic** — Pressures will be set automatically in dynamic control mode in response to **COMPASS** remote commands. **Static** — Pressure will be set automatically in static control mode in response to **COMPASS** remote commands.
Use Ready Criterion (conditional check box)	The option is valid for controllers that have defined **Ready Commands**. The response to a Ready Command signals to **COMPASS** when the controller has achieved its target output (see 4.4.2.1, Ready Commands).
Hold/Stability Unit (list box selection)	Select the unit of measure in which the hold and stability settings are defined.
Hold Setting (numeric entry field)	Defines how close to the target output the controller must be to yield a ready condition. Enter a 0 value to ignore the hold limit in the **COMPASS** ready criterion. For a **DHI** PPCx, controller, the default hold limit is used when 0 is entered in this field. Make sure the **<Use Ready Criterion>** option is checked to use the on board Ready/Not Ready indication as defined in the controllers Operation and Maintenance Manual. In dynamic control mode, this value should be set to 5 to 10 times less than the DUT tolerance if the pressure controller is capable of it. In *static control mode* this value is usually set to 10 to 20 times greater than the DUT tolerance. The hold limit is always set in selected Hold/Stability unit of measure.
Stability Test and Hold Time (required numeric entry fields)	Defines the stability limit to be used to determine a ready condition after a target output is set. Enter a 0 value to ignore the stability limit in the **COMPASS** ready criterion. For a **DHI** PPCx, controller, the default stability limit is used when 0 is entered in this field. Make sure the **<Use Ready Criterion>** option is checked to use the on board Ready/Not Ready indication as defined in the controllers Operation and Maintenance Manual.

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FEATURE	DESCRIPTION
Ready Hold Time (required numeric entry)	Time duration that stability and hold criterion must be met for **COMPASS** to consider that the stability test has been met. The ready condition must be present and uninterrupted for the duration of the Ready Hold Time. If a not ready condition occurs, the hold time countdown starts over after the next ready output is received. This process continues until either the stability test is passed or the **<Stability Time-Out>** occurs. Depending on the configuration of the test system and the performance of the controller, the output may stabilize within the stability test and a ready condition may occur momentarily before the output has truly stabilized. The Stability Hold Time can be used to assure that the output remains stable for a certain amount of time before the stability test is considered to have been met and test execution to continue. When the **<Use Ready>** choice is selected, the ready output from the controller must be maintained for the Ready Hold Time before the output is considered Ready. Use this feature to prevent temporary ready conditions from falsely passing the output control criterion.
Control Timeout (numeric entry field)	Defines the amount of time in seconds before a timeout will occur if a *Ready* condition has not been achieved in response to a set command to an automated controller. If the controller is unable to set the test target and achieve a *Ready* condition within the time-out period, a **<t>** is logged in the **<Status>** column of the data run time test log and in the Data File and test execution proceeds to the dwell step for that point (see 21.5.3, DATA Table). The control time-out assures that a test will not hang up indefinitely waiting to achieve a *Ready* condition at a test point, however data taken after a control time-out is likely to be invalid. Set the control timeout to a value greater than the worst case pressure setting time of the controller. If pressure control is **<Manual>** or **<Reference PG>**, the control timeout is ignored.

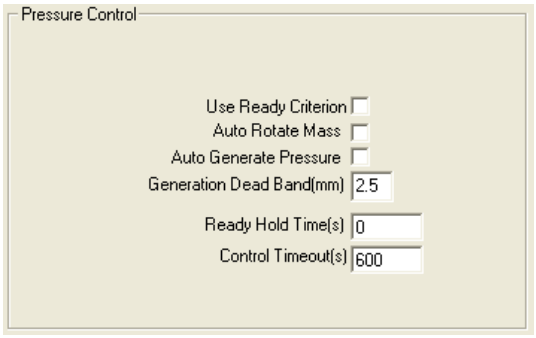

Figure 106. Test Definition Editor, Points Sequence Tab, **[Set]** Child Tab for a PG7000

Table 42. Test Definition Editor, Points Sequence Tab, **[Set]** Child Tab for a PG7000 Fields

FEATURE	DESCRIPTION
Use Ready Criterion (conditional check box)	The option is valid only when the **<Auto Generate Pressure>** option is selected and the selected test pressure controller has **Ready Commands** defined (see 4.4.2.1, Ready Commands). The response to a Ready Command signals to **COMPASS** when the controller has achieved its target output. In the case of a piston gauge, it is assumed that a *Ready* condition is not output by the controller until masses have been manipulated and the piston is floating within acceptable limits.
Auto Rotate PG Mass (conditional check box)	Select this option to automatically enable the **<Auto Rotate>** option of a **DHI** PG7000 set up for remote communication that is equipped with motorized piston rotation. See the PG7000 Operation and Maintenance Manual for additional information on this feature.
Auto Generate PG Pressure (conditional check box)	Select this option to automatically enable the **<Auto Pressure Generation>** option of a **DHI** PG7000 set up for remote communication that is equipped with automated pressure generation. See the PG7000 Operation and Maintenance Manual for additional information on this feature. If a non DHI piston gauge is used, check this option to use an automated test pressure controller. Target commands are sent to the controller using the same method as any other controller in **COMPASS**. The only difference is that the target pressure values are set according to the actual piston gauge pressure and not the target piston gauge pressure. It is assumed that the pressure control process will change mass and float the piston. There is no pause or option to load mass.

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FEATURE	DESCRIPTION
Ready Hold Time (required numeric entry)	The amount of time that the piston gauge must be ready to complete the set pressure test step and move on to the test dwell test step. If an automated means of determining *Ready* is not available, or **<Auto Generate PG Pressure>** is not checked, this entry is ignored.
Auto Generate Dead Band (conditional numeric entry)	Specifies how close to the mid-stroke position the piston should be set when the **<Auto Generate PG Pressure>** option is selected. By default, the value is 1.5mm. See the PG7000 Operation and Maintenance Manual for additional information on this feature. If **<Auto Generate PG Pressure>** is checked and the **<Use Ready Criterion>** option is not checked, this entry represents the +/- piston position limit for the piston gauge to be *Ready*.
Control Timeout (numeric entry field)	Defines the amount of time in seconds before a timeout will occur if a *Ready* condition has not been achieved. If an automated means of determining *Ready* is not available, this entry is ignored.

8.7 [DATA] TAB

The **Test Editor**, **[Data]** tab specifies support hardware to use during Test Initialization, determines the test averaging time and provides options that effect how users can interact with the Test Definition.

The purpose of the **[Data]** tab's fields and settings as well as instructions on how to use them are provided in the table below.

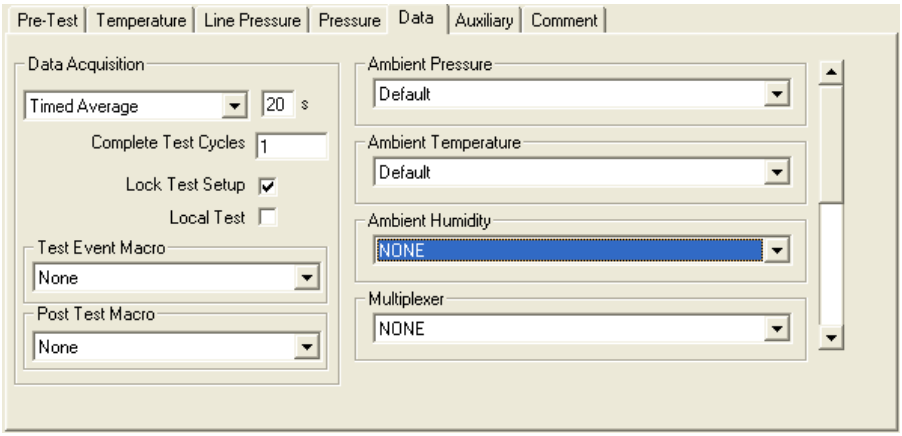

Figure 107. Test Editor, **[Data]** Tab

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Table 43. Test Editor, **[Data]** Tab Fields

FEATURE	DESCRIPTION
Timed/Manual Averaging (list box selection)	Determines a fixed or user selectable time over which data is averaged at each pressure point. When **<Timed>** is specified, **COMPASS** averages for the fixed **<Averaging Time>** entered, 0 to 9999 seconds. **<Manual>** averaging allows either a fixed time or user selectable starting and stopping of averaging at each point. Averaging only occurs in devices that use a remote interface. As many readings as possible are taken during the averaging period. The min, max, standard deviation and number of samples of the reference and DUT are logged to the Data File (see 21.5.3, DATA Table).
Complete Test Cycles (numeric entry)	**COMPASS** can run up to 10 complete test cycles in one test. This includes executing all test operations defined in the test definition for the number of times entered. The pre-test choices are used on the first complete test cycle. Do not confuse this option with the **<Pressure Cycles>** option found on the **[Pressure]** tab.
Lock Test Setup (check box)	Check this option to prevent edits to the test selections during test initialization. This is a useful security option to prevent users from changing references and controllers during test initialization.
Local Test (check box)	Check this option to prevent users on other **COMPASS** stations from accessing this test in a network environment. Use this feature if selections in the test are not valid for other stations.
Test Event Macro (list box selection) (Advanced Tests only)	The selected macro is called prior to each set pressure, test dwell and data collection step in a test sequence. The macro code can be used to alter the sequence of a test in any way desired. For example, the macro can repeat test points, alter the test dwell and averaging times or communicate with other devices in the system based on the current test point and status. In many cases it is more efficient to use this macro selection instead of multiple pre-point macros. Use the **cCOMPASS.CurrentTestStep** property as needed in the macro code to determine the current step in a test (see 28.9.1). Select **<None>** if a macro is not desired. This option is available in Advanced Tests only (see **Test Editor**, 8.2).
Post Test Macro (list box selection) (Advanced Tests only)	The selected macro is called at the end of a test, after all test points are complete and before any test notes are entered by the user. The macro is not called if a test is aborted early for any reason. This macro is frequently used to return test instruments to a normal state or to send special commands to devices at the end of a test. In other cases, this macro can be used to determine new calibration data for DUTs and send commands to the DUTs to update their calibration data. It is not necessary to use this macro to vent test devices. Instead make sure that the **<Use Remote Vent>** option is selected in the definition of any controller that you wish to vent (see **[Set] Tab**, 4.3.7). This is true for both pressure and temperature controllers. This option is available in Advanced Tests only.
Ambient Pressure, Ambient Temperature, ect (list box selection)	The selection in each frame defines the default test selection for the corresponding quantity. By specifying a specific device in the Test Definition, no selection is required during Test Initialization. If a quantity is not required, select **<None>**. Use the **<Default>** selection to use the devices selected in the **Default Hardware Configuration** (see **[Setup], [Default Hardware Configuration]**,12)

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8.8 [AUXILIARY] TAB

The Test Editor, **[Auxiliary]** tab is used to specify what devices to use for auxiliary data. Auxiliary data devices can be any type and any range. Typically, auxiliary devices are used to log test specific data that would not normally be logged by **COMPASS**. For example, the excitation voltage of a DUT. The output of any instrument in the **COMPASS** database can be used as auxiliary data. It is not necessary to use an auxiliary data selection to log the raw output of a DUT or reference. This data is logged automatically.

Double click a device in the list to add it to the selected auxiliary data devices. Press **[Remove]** or double click selected devices to remove them from the list of selected auxiliary devices.

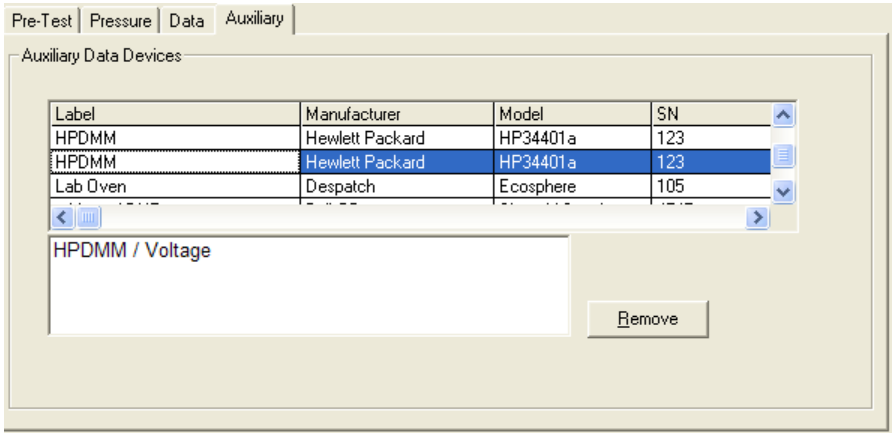

Figure 108. Test Editor, **[Auxiliary]** Tab

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9. [SETUP], [DUT]

9.1 OVERVIEW

COMPASS is organized around the support, testing and maintenance of Devices Under Test (DUTs). DUT Definitions not only specify the relationship between raw device outputs and pressure; they determine how the output data will be acquired and maintain calibration and tracking information for the device. A DUT can be setup to provide DUT pressure only or to include pressure control and measurement of other variables.

See Section 3.3, Device (instrument) Support Concept, to get a thorough understanding of how COMPASS handles devices and final outputs. An understanding of this topic is critical to proper setup of the [Output] tab. Then review 4.3, Device Editors, for details on how the COMPASS device editors function.

Rights associated with the active COMPASS user may prevent edits in the DUT Editor. Adjust the user rights as necessary using the [Database],[Users] menu choice.

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9.2 DUT EDITOR

The DUT Editor provides features to create, edit, view and remove DUT Definitions from the **COMPASS** database. Access the DUT Editor using the **[Setup], [DUT]** menu option or the Main Toolbar, **[DUT Editor]** icon. When selected, the last accessed DUT Definition displays. To edit an existing DUT, use the Editor Toolbar features to select the desired DUT. Then simply edit the desired fields. Press the Editor Toolbar, **[Save]** icon to save the changes.

The DUT Editor is a **COMPASS** Device Editor. See 4.3, Device Editors, for complete information on creating, editing and saving Device Definitions using Device Editors.

Use the following steps to create a DUT Definition.

❶ Select **[Setup], [DUT]**

❷ Press the Editor Toolbar, **[New]** icon (see 4.2, Editor Toolbar).

❸ Enter a **<Record Label>** that allows users to quickly identify the defined DUT.

❹ Begin completing the DUT Definition starting with the [Header] tab. Select a **<DUT Type>** and a **<Record Type>**.

DUTs can be defined as <Individual>, <Profile> and <Profile w/Range>. These selections allow an explicit DUT to be created including specific range and serial number information; or, a profile DUT that is identified during the test initialization process. Profile DUTs allow one DUT Definition to represent any number of like <Model> devices from the same <Manufacturer>.

---

❺ Select the **<Manufacturer>** and **<Model>** on the **[Header]** tab. If the desired selections are in the drop down list, press the **[Find Previous Setup]** button to search for previous setups or examples of the DUT. If the **<Manufacturer>** and **<Model>** are not in the list, enter them.

❻ Enter relevant information on the **[Calibration]** tab.

❼ Select the appropriate **<Data Acquisition Type>** and corresponding settings using the **[Communications]** tab.

❽ If applicable, select the **[Output]** tab. Simple DUTs allow direct entry of all relevant final output information. To create a final output for advanced DUTs, press the **[Add]** button and edit the information on the Output Relationship Editor (see 4.3.6.2, Output Relationship Editor). If the final output requires remote commands to read the **<Raw Output>**, press the **[Edit Commands]** button to launch the Remote Command Editor (see 4.4, Remote Command Editor). Simple DUT remote commands are accessed on the **[Communications]** tab. Specify the commands required to interface with the device. Press the **[Add]** button to add as many final outputs as are supported by the DUT.

❾ Advanced DUTs can be used as controllers. If this is the case, select the **[Set]** tab. To create a final output for advanced DUTs, press the **[Add]** button and edit the information on the **<Set Relationship>** form. If the set output requires remote commands to control the device, press the **[Edit Commands]** button to launch the **<Remote Command Editor>**. Pressure controlling set outputs can optionally use remote Ready/Not Ready indication, Control Abort and Vent commands. Press the **[Add]** button to add as many set outputs as are supported by the DUT.

❿ Press the Editor Toolbar, **[Save]** icon to save all changes. Any errors in the setup must be remedied before the DUT Definition can be saved.

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10. [SETUP], [SUPPORT DEVICE]

10.1 OVERVIEW

All devices that are not specifically DUTs or Piston Gauges are considered support devices. Support devices are setup for use by **COMPASS** in Support Device Definitions using the Support Device Definition Editor. Device Definitions define reference and support devices that measure and produce outputs as well as devices that control in response to target sets. A Support Device Definition can also allow the device to act as a DUT to allow it to be tested and calibrated in **COMPASS** without having to set it up separately as a DUT. A single device can provide multiple final outputs and final sets.

See Section 3.3, Device (instrument) Support Concept, to get a thorough understanding of how COMPASS handles devices and final outputs. An understanding of this topic is critical to proper setup of the [Output] tab. Then review 4.3, Device Editors, for details on how the COMPASS device editors function.

Rights associated with the active COMPASS user may prevent edits in the Device Definition Editor. Adjust the user rights as necessary using the [Database],[Users] menu choice.

The Support Device Editor provides features to create, edit, view and remove Support Device Definitions from the **COMPASS** database. Access the Support Device Editor using the **[Setup], [Support Device]** menu option or the Main Toolbar **[Device Definition Editor]** icon. When selected, the last accessed Support Device Definition displays. To edit an existing Support Device Definition, use the Editor Toolbar icons to select the desired definition. Then simply edit the desired fields. Press the Editor Toolbar, **[Save]** icon to save the changes.

Device Definitions are defined and maintained in the same manner as DUT Definitions.

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The DUT Editor is a **COMPASS** Device Editor. See 4.3, Device Editors for complete information on creating, editing and saving Device Definitions using Device Editors.

Use the following steps to create a Support Device Definition:

❶ Press the Editor Toolbar, **[New]** option.

❷ Enter a **<Record Label>** that allows users to quickly identify a unique Support Device Definition.

❸ Begin defining the Device Definition starting with the [Header] tab. Select the **<Manufacturer>** and **<Model>** on the **[Header]** tab. If the desired selections are in the list, press the **[Find Previous Setup]** button to search for previous setups or examples of the Support Device Definition. If the **<Manufacturer>** and **<Model>** are not in the list, enter them.

❹ Enter relevant information on the **[Calibration]** tab.

❺ Select the appropriate **<Data Acquisition Type>** and corresponding settings using the **[Communications]** tab.

❻ If applicable, select the **[Output]** tab. Press the **[Add]** button to create a final output and edit the information on the Output Relationship Editor. If the final output requires remote commands to read the raw output, press the **[Edit Commands]** button to launch the Remote Command Editor. Specify the commands required to interface with the device. Press the **[Add]** button to add as many final outputs as are supported by the device.

❼ If applicable select the **[Set]** tab to define controllable outputs. Press the **[Add]** button and edit the information on the Set Relationship Editor. If the final set requires remote commands to control the device, press the **[Edit Commands]** button to launch the Remote Command Editor. Pressure and temperature controlling sets can optionally use remote *Ready/Not Ready* indication, Control Abort and Vent commands. Press the **[Add]** button to add as many final sets as are supported by the device.

Press the Editor Toolbar, **[Save]** option to save all changes. Any errors in the setup must be remedied before the Support Device Definition save operation can be completed.

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11. [SETUP], [PISTON GAUGE]

11.1 OVERVIEW

See Section 17, [Tools], [PG7000 Setup Extractor] for information on setting up a DHI PG7000 piston gauge.

Piston gauges and Deadweight testers, whether used as a DUT or a reference, are set up and stored using the Piston Gauge Platform Editor. A Piston Gauge Platform defines the specific type of Piston Gauge, identifies which Piston-Cylinders, Mass Sets and Mass Bells are normally used with the platform and optionally defines how piston position and rotation information will be obtained when the platform is operated. A Piston Gauge Platform can also specify final outputs and sets. As with all device definitions in **COMPASS**, a single device can provide multiple outputs and sets.

See Section 3.3, Device (instrument) Support Concept, to get a thorough understanding of how COMPASS handles devices and final outputs. An understanding of this topic is critical to proper setup of the [Output] tab. Then review 4.3, Device Editors, for details on how the COMPASS device editors function.

Rights associated with the active COMPASS user may prevent edits in the Piston Gauge Platform Editor. Adjust the user rights as necessary using the [Database],[Users] menu choice.

There are two types of Piston Gauges Platforms: Piston Gauge Type and Deadweight Tester Type. The selection is made on the **[Header]** tab of the Piston Gauge Platform Editor. Piston Gauge Type Platforms define the output pressure by solving the pressure equation using the effective area of the piston-cylinder and the force applied by the mass load. Deadweight Tester Type Platforms define the output pressure by summing the pressure values assigned to all of the loaded masses. A Platform must be used with metrological components (piston-cylinder, mass set, mass bell) of the same type (Piston Gauge or Deadweight Tester).

Piston-Cylinders, Mass Sets and Mass Bells must be defined to use a Platform. These setup are in their own editors. A Platform must be used with metrological elements that are of the same type as the platform type (Piston Gauge or Deadweight Tester).

11.2 [PISTON GAUGE PLATFORM]

The Piston Gauge Platform Editor provides features to create, edit, view and delete Piston Gauge Platforms from the **COMPASS** database. Access the Piston Gauge Platform Editor using the **[Setup], [Piston Gauge]**,**[Piston Gauge Platform]** menu option or the Main Toolbar, **[Piston Gauge Platform Editor]** icon. When the editor is opened, the last accessed Piston Gauge Platform displays. Use the Editor Toolbar to create a new platform, select a platform to be edited or copy a platform to be edited. Then simply edit the desired fields. Press the Editor Toolbar, **[Save]** icon to save the changes.

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The Piston Gauge Platform Editor is a **COMPASS** Device Editor. See 4.3, Device Editors for complete information on creating, editing and saving Device Definitions using Device Editors.

Piston-Gauge Platform setups do not require an Output or Set. A valid setup only requires selections on the [Header] tab. Using default selections on all other fields and tabs is common.

Use the following steps to create a Piston Gauge Platform:

❶ Select **[Setup]**, **[Piston Gauge]**, **[Piston Gauge Platform]**.

❷ Press the Editor Toolbar, **[New]** icon (see 4.2, Editor Toolbar).

❸ Enter a **<Record Label>** that allows users to quickly identify the defined platform.

❹ Begin completing the Piston Gauge Platform Definition starting with the **[Header]** tab. Select the **<Manufacturer>** and **<Model>**. If the desired selections are in the list, press the **[Find Previous Setup]** button to search for previous setups or examples of the Platform Definition. If the **<Manufacturer>** and **<Model>** are not in the list, enter them.

❺ Select the **<Platform Type>**. For Piston Gauge Type platforms output pressure is calculated from piston-cylinder effective area and mass load, for Deadweight Tester Type platforms output pressure is calculated by summing the pressure value assigned to the loaded masses.

❻ Enter relevant information on the **[Calibration]** tab (see 4.3.4, [Calibration] Tab).

❼ Go to the **[P-C/MS]** tab and specify the Piston-Cylinders, Mass Sets and Mass Bells that the Piston Gauge Platform supports (see 11.2.3, [P-C/MS] Tab). By default, all defined metrological elements are available. Limiting the choices on this tab will prevent errors during Test Initialization. Remember that Piston Gauge Type platforms must have piston gauge type metrological elements and Deadweight Tester Type platforms must have Deadweight tester type metrological elements.

❽ Go to the **[Sources]** tab and specify the Platform Condition Sources (see 11.2.4, [Sources] Tab). Piston position, rotation and temperature are not required selections. If devices are available to output these values, select them in the appropriate lists. Piston Gauges that measure absolute pressure with a vacuum reference require a vacuum reference device to read the residual vacuum pressure.

❾ Go to the **[Communications]** tab and specify the appropriate **<Data Acquisition Type>** and corresponding settings. Most Piston Gauge Platforms, other than **DHI** PG7000s, do not have a remote interface. If the Platform does not have an interface, **<Manual>** is the **<Data Acquisition Type>** selection.

❿ If applicable, select the **[Output]** tab. Press the **[Add]** button to create a final output and edit the information on the Output Relationship Editor. If the final output requires remote commands to read the **<Raw Output>**, press the **[Edit Commands]** button to launch the Remote Command Editor (see 4.4, Remote Command Editor). Specify the commands required to interface with the device. Press the **[Add]** button to add as many final outputs as are supported by the platform. Note that **DHI** piston gauge platforms set up using **<Auto detect setup>** do not have a read tab and most other piston gauges do not final outputs to be read. Therefore, the **[Output]** tab is not usually used for a Piston Gauge Platform.

⓫ If applicable select the **[Set]** tab to define final sets. Press the **[Add]** button and edit the information on the Set Relationship Editor. If the final set requires remote commands to control the device, press the **[Edit Commands]** button to launch the Remote Command Editor. Pressure and temperature sets can optionally use remote *Ready/Not Ready* indication, Control Abort and Vent commands. Press the **[Add]** button to add as many final sets as are supported by the Platform.

Press the Editor Toolbar, **[Save]** icon save all changes. Any errors in the setup must be remedied before the Piston Gauge Platform Definition can be saved.

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11.2.1 [HEADER] TAB

See section 4.3.3, [Header] Tab.

11.2.2 [CALIBRATION] TAB

See section 4.3.4, [Calibration] Tab.

11.2.3 [P-C/MS] TAB

The **[P-C/MS]** (Piston-Cylinder/Mass Set) tab is used to define which metrological elements are available for use with a Piston Gauge Platform. This tab is available on the Piston Gauge Platform Editor only. In most cases, not all metrological elements defined in the **COMPASS** database can be used with a given platform. Limiting the list of selections of each type of metrological element that is available for use with a platform prevents errors and saves time during Test Initialization. During Test Initialization, **COMPASS** only offers elements specifically setup on this tab when the platform is being used. When an incorrect metrological element is used during a test, significant errors can occur.

Press the Editor Toolbar, **[Edit]** icon next to the specific metrological element to edit the corresponding list. A prompt to **<Support All>** displays when the **[Edit]** button is pressed. It is recommended to use the **<Support All>** choice only when all the metrological elements in the **COMPASS** database can be used with the PG7000 Platform that is being setup. If the response to the prompt to **<Support All>** is **<No>**, the **COMPASS** Piston-Cylinder, Mass Set or Mass Bell Selector displays to allow the specific element to be selected (see figure below). Double-click elements on the left side of the list to add them to the list of supported items. Double click the items on the right side of the display to remove them from the supported list.

When selecting piston-Cylinders, Mass Sets and Mass Bells to be used with a Piston Gauge Platform, keep in mind that metrological elements used with a platform must be of the same type as the platform (Piston Gauge or Deadweight Tester).

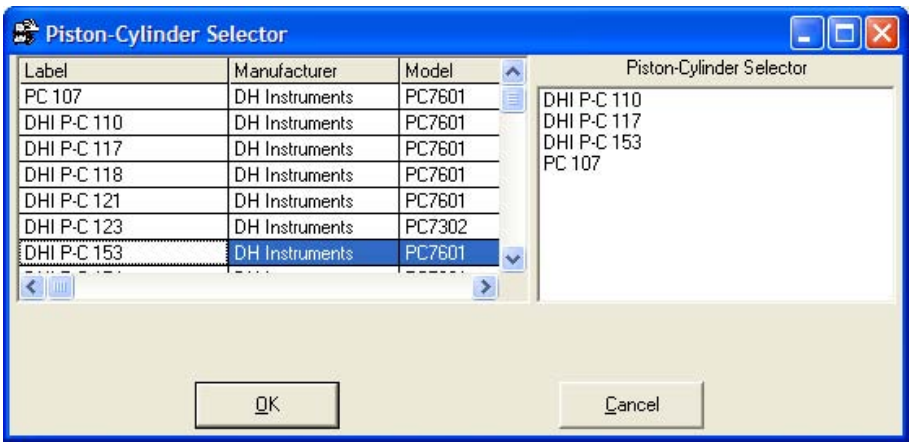

Figure 109. Piston-Cylinder Selector

Metrological elements linked to a specific Piston Gauge Platform are still available for use with other Piston Gauge Platforms.

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See **Table 44.** Piston Gauge Platform Editor, **[P-C/MS]** Tab Fields for complete descriptions of all the tab's fields.

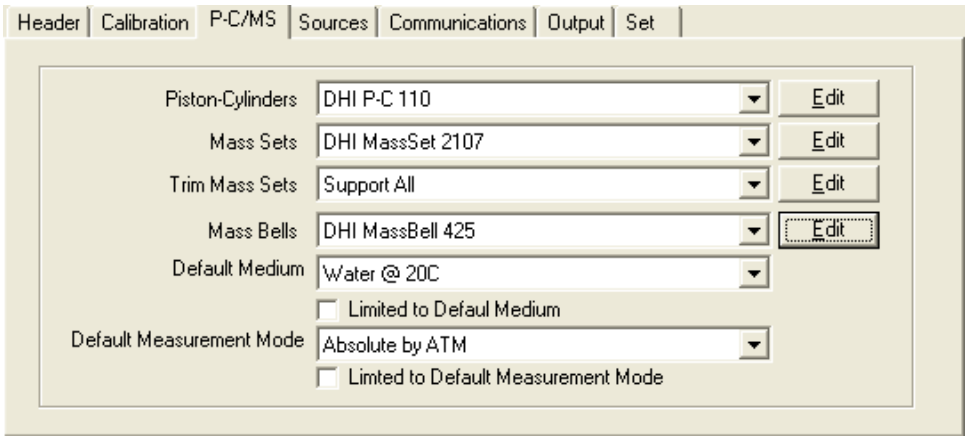

Figure 110. Piston Gauge Platform Editor, **[P-C/MS]** Tab

Table 44. Piston Gauge Platform Editor, **[P-C/MS]** Tab Fields

FEATURE	DESCRIPTION
Piston-Cylinders (optional list box selection)	The list contains all the piston-cylinders that can be used with the Piston Gauge Platform. Press the **[Edit]** button next to this field to modify the list of available piston-cylinders. Up to 17 individual Piston-Cylinders can be linked to a Piston Gauge Platform.
Mass Sets (optional list box selection)	The list contains all of the mass sets that can be used with the Piston Gauge Platform. Press the **[Edit]** button next to this field to modify the list of available mass sets. Up to five individual mass sets can be linked to a Piston Gauge Platform.
Trim Mass Sets (optional list box selection)	The list contains all of the trim mass sets that can be used with the Piston Gauge Platform. Press the **[Edit]** button next to this field to modify the list of available trim mass sets. Up to give individual trim mass sets can be linked to a Piston Gauge Platform.
Mass Bells (optional list box selection)	The list contains all of the supported mass bells for the Piston Gauge Platform. Press the **[Edit]** button next to this field to modify the list of available mass bells. Up to five individual mass bells can be linked to a Piston Gauge Platform.
Default Medium (optional list box selection)	Define the test pressure medium to use by default. The list of available media is determined by the **Pressure Media Editor**. If the Piston Gauge Platform is designed for a specific medium, check the **<Limited to <Default Medium>>** option. This prevents the Test Initialization from allowing the medium to be changed when the Piston Gauge Platform is selected.
Default Measurement Mode (optional list box selection)	Define the default pressure measurement mode to use when initializing the Piston Gauge Platform. If the Piston Gauge Platform will always be used in a single, specific measurement mode, check the **<Limited to <Default Measurement Mode>>** option. This prevents the Test Initialization from allowing the pressure measurement mode to change when the Piston Gauge Platform is selected.

11.2.4 [SOURCES] TAB

The choices on the **Piston Gauge Platform Editor**, **[Sources]** tab define specific devices to use to provide final outputs needed in determining the behavior of and the pressure defined by the Piston Gauge Platform. Making selections on this tab can avoid having to select sources during Test Initialization. The selected devices are used to measure the residual vacuum (when applicable), piston-cylinder temperature, piston rotation rate and position. The **Piston Gauge Run Screen** displays the output of the selected devices when tests are run.

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Each list contains all devices that support the platform condition final output. A selection is not required. Review the Piston Gauge Calculations section of this manual for details on how the platform condition values are used.

If the platform under edit contains the desired outputs to use in a source field, define the outputs and save the platform before making selections on this tab. The outputs will not be available until the platform is saved.

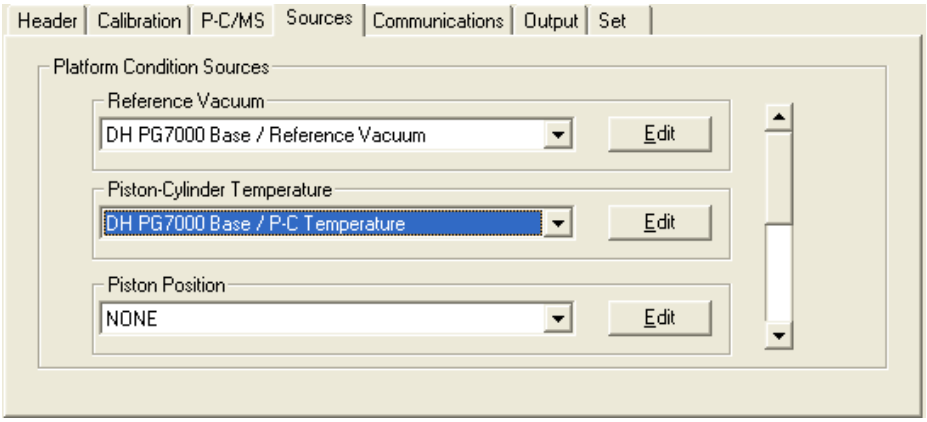

Figure 111. Piston Gauge Platform Editor, **[Sources]** Tab

Table 45. Piston Gauge Platform Editor, **[Sources]** Tab Fields

FEATURE	DESCRIPTION
Reference Vacuum (optional list box selection)	Select the device to use to measure the residual pressure under the piston gauge bell jar absolute by vacuum measurement mode. Deadweight Tester type Piston Gauges and Piston Gauges that do not support absolute by vacuum measurement mode do not use this selection. During Test Initialization, the selected value is the default **<Reference Vacuum>** choice for the Piston Gauge. The selection can be changed if desired. The residual pressure under the piston gauge bell jar added to the calculated piston gauge pressure to define the final pressure.
Piston-Cylinder Temperature (optional list box selection)	Select the device to use to measure the piston-cylinder temperature. Deadweight Tester type Piston Gauges do not use this selection. During test initialization, the selected value is the default **<Piston-Cylinder Temperature>** selection for the Piston Gauge. The selection can be changed if desired. The piston-cylinder temperature is used to calculate the effective area of the piston-cylinder at its operating temperature.
Piston Position (optional list box selection)	Select the device to use to measure the piston position. During test initialization, the selected value is the default **<Piston Position >** selection for the Piston Gauge. The selection can be changed if desired. The piston position is used to calculate the pressure head resulting from the piston not being at its reference level (0 position). It is also used to provide a display of piston position on the Platform's **Device Run Screen**.
Piston Rotation Rate (optional list box selection)	Select the device to use to measure the piston rotation rate. During test initialization, the selected value is the default **<Piston Rotation Rate >** selection for the Piston Gauge. The selection can be changed if desired. The rotation rate is not used in any pressure calculations for the Piston Gauge. However, it is used to determine the Piston Gauge's *Ready/Not Ready* criterion as defined for the active piston-cylinder.

11.2.5 [COMMUNICATIONS] TAB

See section 4.3.5, [Communications] Tab.

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11.2.6 [OUTPUT] TAB

See section 4.3.6, [Output] Tab.

11.2.7 [SET] TAB

See section 4.3.7, [Set] Tab.

11.3 [PISTON-CYLINDER]

The **Piston-Cylinder Editor** provides features to create, edit and remove Piston-Cylinders that are used with Piston Gauge Platforms by **COMPASS**. Use the Main Toolbar shortcut or **[Setup]**, **[Piston Gauge]**, **[Piston-Cylinder]** to access the Piston-Cylinder Editor.

Information on metrological elements (piston-cylinders and masses) entered in DHI PG7000 piston gauges can be extracted into COMPASS using the PG7000 Setup Extractor. This avoids having to manually enter existing Piston-Cylinder information.

A Piston-Cylinder setup in COMPASS is not necessary when direct remote pressure access of a DHI PG7000 is used with the <Autodetect Setup> option (see 4.3.3, [Header] Tab). The remote pressure output of the PG is fully compensated for all conditions and is not modified by COMPASS. Features are provided during test initialization to pick the current Piston-Cylinder setup inside the PG7000.

A Piston-Cylinders setup is required by a Piston Gauge Platform to be used in **COMPASS**. There are two types of Piston-Cylinders: **<Piston Gauge>** and **<Deadweight Tester>**. The difference is that **<Piston Gauge>** Piston-Cylinders require the entry of fundamental effective area information on the piston-cylinder to solve the pressure equation. **<Deadweight Tester>** Piston-Cylinders simply require the entry of their corresponding pressure. Select the **<Piston Gauge Type>** using the **[Header]** tab of the Piston-Cylinder Editor (4.3.3, [Header] Tab).

There are two types of piston-cylinders: Piston Gauge Type and Deadweight Tester Type. The selection is made on the **[Header]** tab of the Piston-Cylinder Editor. Piston Gauge Type Piston-Cylinders are used with Piston Gauge Type Platforms and output pressure is defined by solving the pressure equation using the effective area of the piston-cylinder and the force applied by the mass load. Deadweight Tester Type Piston-Cylinders are used with Deadweight Tester Type Platforms and output pressure is defined by summing the pressure values assigned to all of the loaded masses. A Piston-Cylinder must be used with a platform of the same type as the Piston-Cylinder (Piston Gauge or Deadweight Tester).

After a Piston-Cylinder is defined, future changes using the editor are required only for maintenance purposes (updates in effective area or corresponding pressure). For this reason and due to the critical metrological impact errors in the Piston-Cylinder can cause, restricting user access to the **Piston-Cylinder Editor** is highly recommended. Administrative users can assign user rights with **[Database]**,**[Users]**.

Edit Piston-Cylinders by selecting the appropriate tab and editing the necessary information. Press the **Editor Toolbar**, **[Save]** icon save changes to the setup. The following sections describe the options on the **Piston-Cylinder Editor**.

11.3.1 [HEADER] TAB

See section 4.3.3, [Header] Tab.

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11.3.2 [CALIBRATION] TAB

See section 4.3.4, [Calibration] Tab.

11.3.3 [TOLERANCE] TAB

When the Piston-Cylinder Type specified on the **Piston-Cylinder Editor**, **[Header]** tab Is Piston Gauge, the tolerance on the piston-cylinder effective area and mass value are specified on the **[Tolerance]** tab (see 4.3.6.2.3, [Tolerance] Tab).

When the Piston-cylinder Type specified on the **Piston-Cylinder Editor**, **[Header]** tab is Deadweight Tester, there is no tolerance information for the piston-cylinder. The tolerance in pressure is giving in the deadweight tester mass set.

11.3.4 [CHARACTERISTICS] TAB

Refer to section 29.8, Piston Gauge Pressure Calculations for details on how the fields on the [Characteristics] tab are used to solve the pressure equation.

11.3.4.1 PISTON GAUGE TYPE PISTON-CYLINDER

When the Piston-Cylinder Type specified on the **Piston-Cylinder Editor**, **[Header]** tab is Piston Gauge, the **Piston-Cylinder Editor**, **[Characteristics]** tab displays the fields listed below. The Piston-Cylinders **[Characteristics]** tab provides the piston-cylinder specific variables necessary to solve the pressure equation when the Piston-Cylinder is used with a Piston Gauge Platform. Entries that have an asterisk ("*") next to them are required. Generally, the necessary values are listed in the Piston-Cylinder's calibration report and/or the Piston Gauge or Deadweight Tester's Operation and Maintenance Manual.

Errors in values entered into the Piston-Cylinder [Characteristics] tab directly impact the calculation of Piston-Gauge pressure when the Piston-Cylinder is used. Typically, a pressure span error results. Make sure that all values are entered in the proper unit of measure.

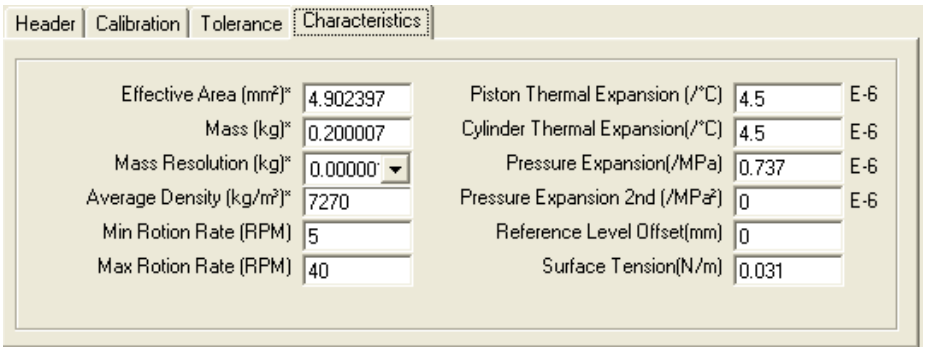

Figure 112. Piston-Cylinder Editor, Piston Gauge Type **[Characteristics]** Tab

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Table 46. Piston-Cylinder Editor, Piston Gauge Type **[Characteristics]** Tab Fields

FEATURE	DESCRIPTION
Effective Area (required numeric entry)	The effective area of the Piston-Cylinder at 20 °C and 0 pressure. The value must be entered in square millimeters [mm^2].
Mass (required numeric entry)	The mass of the piston or cylinder (whichever is floated). The value must be entered in kilogram [kg].
Mass Resolution (required drop down list selection)	The resolution with which mass values are entered in the <Mass> field stored in the **<Individual Masses>** list. The resolution option is necessary to avoid rounding and truncating errors when determining target pressures given a mass load when using the **Piston Gauge Calculator**.
Average Density (required numeric entry)	The average or apparent density of the piston or cylinder assembly (whichever is floated): piston or cylinder + head + cap. The value must be entered in kilogram per cubic meter [kg/m^3].
Min Rotation Rate (optional numeric entry field)	The minimum rotation rate at which a *Ready* condition can occur when operating the Piston-Cylinder. This value is applicable to Piston Gauge Platforms that are setup to use a Piston-Cylinder rotation measuring device. It is not used if there is no rotation rate measurement. The value must be entered in rotations per minute [rpm].
Max Rotation Rate (optional numeric entry field)	The maximum rotation rate at which a *Ready* condition Can occur when operating the Piston-Cylinder. This value is applicable to Piston Gauge Platforms that are setup to use a Piston-Cylinder rotation measuring device. It is not used if there is no rotation rate measurement. The value must be entered in rotations per minute [rpm].
Piston Thermal Expansivity (optional numeric entry)	Enter the value of the piston material linear thermal expansivity. The value must be entered in terms of relative change per degree centigrade relative to 20 °C [nn x 10^{-6}/°C]. The 10^{-6} exponent is fixed. The default is 0, which results in no effective area change due to expansion of the piston as a result of temperature changes.
Cylinder Thermal Expansivity (optional numeric entry)	Enter the value of the cylinder material linear thermal expansivity. The value must be entered in terms of relative change per degree centigrade relative to 20 °C [nn x 10^{-6}/°C]. The 10^{-6} exponent is fixed. The default is 0, which results in no effective area change due to expansion of the cylinder as a result of temperature changes.
Pressure Expansion (optional numeric entry)	The value of the piston-cylinder change in effective area with measured pressure in terms of relative change per Mega Pascal relative to zero pressure [nn x 10^{-6}/MPa]. The 10^{-6} exponent is fixed. Use the **Unit of Measure Converter** to convert the coefficient to MPa if needed.
Pressure Expansion 2nd (optional numeric entry)	**T**he value of the piston-cylinder change in effective area in terms of relative change per Mega Pascal squared relative to zero pressure [nn x 10^{-6}/MPa]. The 10^{-6} exponent is fixed. This second order term is used only when the expansion of the Piston-Cylinder due to pressure has a second order relationship. Use the **Unit of Measure Converter** to convert the coefficient to MPa if needed.
Reference Level Offset (optional numeric entry)	The value of the reference level offset which corrects the piston-cylinder reference level for hollow pistons to the reference level marked on the mounting post of the Piston Gauge Platform. The value must be entered in millimeters [mm]. This field is used only with **DHI** Piston-Cylinders that have a hollow piston. In other cases, the value should be zero.
Surface Tension (optional numeric entry)	The value of the surface tension effect of the pressurized fluid on the piston. The value must be entered in Newtons per meter, [N/m]. The correct value for all **DHI** gas lubricated and liquid lubricated, gas operated piston-cylinders (PG7102, PG7601 and PG7202) is 0 unless they are operated with oil as the test medium. The value is a positive number for oil operated, oil lubricated piston-cylinders.

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11.3.4.2 DEADWEIGHT TESTER TYPE PISTON-CYLINDER

When the Piston-Cylinder Type specified on the **Piston-Cylinder Editor**, **[Header]** tab is Deadweight Tester, the **Piston-Cylinder Editor**, **[Characteristics]** tab displays the fields listed below. The Piston-Cylinders **[Characteristics]** tab defines the pressure at which the piston floats. Entries that have an asterisk ("*") next to them are required. There are no calculations other than summing the pressure value of the loaded mass and piston and making a gravity correction when a Deadweight Tester is used.

Errors in values entered into the Piston-Cylinder [Characteristics] tab directly impact the calculation of Piston-Gauge pressure when the Piston-Cylinder is used. Typically, a pressure span error results. Make sure that all values are entered in the proper unit of measure.

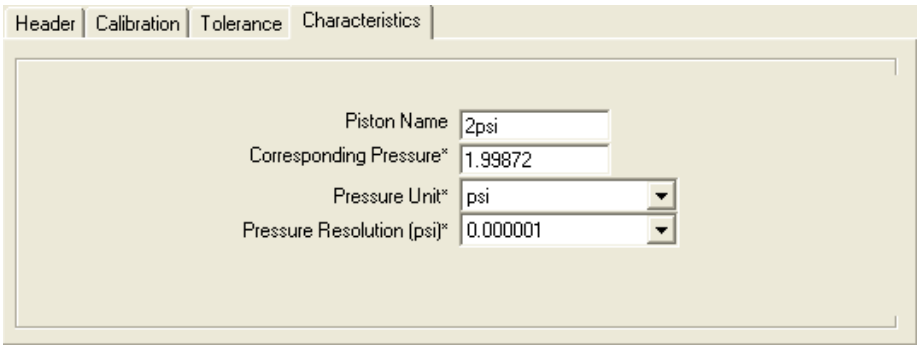

Figure 113. Piston-Cylinder Editor, Deadweight Tester Type **[Characteristics]** Tab

Table 47. Piston-Cylinder Editor, Deadweight Tester Type **[Characteristics]** Tab Fields

FEATURE	DESCRIPTION
Piston Name (optional numeric entry)	The name to associate with the Piston-Cylinder. The name displays next to the corresponding Piston-Cylinder pressure in the **<Mass List>** of the **Piston Gauge Calculator**.
Corresponding Pressure (required numeric entry)	The pressure at which the piston floats in the unit of measure specified in the **<Pressure Unit>** field. The value is added to the total pressure defined by the masses loaded. Note that **COMPASS** assumes the piston mass is adjusted to float the specified pressure when at the same local gravity that is specified in the mass set being used with the Deadweight tester.
Pressure Unit (required drop down list)	The pressure unit of measure in which the value in the **<Corresponding Pressure>** field is expressed. Use the **Unit of Measure Converter** to convert pressure units if needed.
Pressure Resolution (required drop down list selection)	The resolution to use for the **<Corresponding Pressure>** entry.

11.4 [MASS SET]

The Mass Set Editor provides features to create, edit and remove Mass Sets that are used with Piston Gauge Platforms by **COMPASS**. Use the Main Toolbar shortcut or **[Setup]**, **[Piston Gauge]**, **[Mass Set]** to access the Mass Set Editor.

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Information on metrological elements (piston-cylinders and masses) entered in DHI PG7000 piston gauges can be extracted into COMPASS using the PG7000 Setup Extractor. This avoids having to manually enter existing Piston-Cylinder information.

A Mass Set setup in COMPASS is not necessary when direct remote pressure access of a DHI PG7000 is used with the <Autodetect Setup> option. The remote pressure output of the PG is fully compensated for all conditions and is not modified by COMPASS. Features are provided during test initialization to pick the current Mass Set setup inside the PG7000.

A Mass Set setup is required for a Piston Gauge Platform to be used in **COMPASS**. There are three types of Mass Sets: **<Piston Gauge>**, **<Piston Gauge Trim Mass>** and **<Deadweight Tester>**. The difference is that **<Piston Gauge>** Mass Sets require the entry of true mass information for the masses in the mass set so that **COMPASS** can solve the pressure equation. **<Deadweight Tester>** Piston-Cylinders simply require the entry of their corresponding pressures. Select the **<Mass Set Type>** in the **[Header]** tab of the Mass Set Editor.

After a Mass Set is defined, future changes using the editor are required only for maintenance purposes (updates in effective area or corresponding pressure). For this reason and due to the critical metrological impact errors in Mass Sets can cause, restricting user access to the **Mass Set Editor** is highly recommended. Administrative users can assign user rights with **[Database]**,**[Users]**.

Edit Mass Sets by selecting the appropriate tab and editing the necessary information. Use the **Editor Toolbar** in the **[Mass Set]** tab to create, save and delete individual masses in non-trim mass Mass Sets. Individual masses must be saved prior to creating a new mass. Press the **[Save]** option on the main **Editor Toolbar** to save all changes to the setup. The following sections describe the options on the **Mass Set Editor**.

11.4.1 [HEADER] TAB

See section 4.3.3, [Header] Tab.

11.4.2 [CALIBRATION] TAB

See section 4.3.4, [Calibration] Tab.

11.4.3 [MASS SET] TAB

Refer to section 29.8, Piston Gauge Pressure Calculations for details on how the fields on the [Mass Set] tab are used to solve the pressure equation.

Options in COMPASS are available to alter how the list of Mass Set masses display. See section 14.6, [Piston Gauge] Tab, for details on these features.

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11.4.3.1 PISTON GAUGE TYPE MASS SET

When the Mass Set Type specified on the **Mass Set Editor**, **[Header]** tab is Piston Gauge, the **mass Set Editor**, **[Mass Set]** tab displays the fields listed below. The Mass Set **[Mass Set]** tab provides the true mass and density of all the masses in the mass set. Each mass selection in the **<Individual Masses>** list updates the specific mass's information on the right side of the tab. Entries that have an asterisk ("*") next to them are required.

Errors in values entered into the Mass Set [Mass Set] tab directly impact the calculation of Piston Gauge pressure when the Mass Set is used. Typically, a pressure span error results. Make sure that all values are entered in the proper unit of measure.

The information on the bottom right of the tab applies to all masses in the <Individual Masses> list. Select a mass in the <Individual Masses> list to view information specific to that mass. Changes to each mass must be saved prior to using the inset Editor Toolbar.

For Piston Gauge Type Mass Sets, mass carrying bells have their own setup. For Deadweight Tester Type Mass Sets, the mass bell or carriage must be set up as an individual mass of the Mass Set.

For Piston Gauge Type Mass Sets, trim mass sets have their own setup. A trim mass set is a mass set, generally made up of masses of less than 0.1 kg, that is used in combination with a mass set to load mass values more precisely than is possible with just the regular mass set.

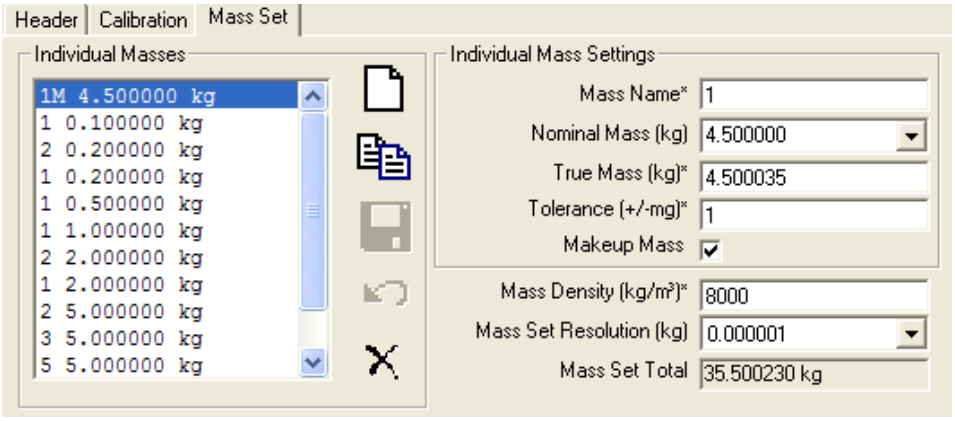

Figure 114. Mass Set Editor, Piston Gauge Type **[Mass Set]** Tab

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Table 48. Mass Set Editor, Piston Gauge Type **[Mass Set]** Tab Fields

FEATURE	DESCRIPTION
Mass Name (optional numeric entry)	An easily identifiable description of an individual mass. When masses are used in operation, they are listed and need to be recognized by the value entered in this field and their **<Nominal Mass>** or **<True Mass>** values. Typically, the label used is a mass number and nominal mass value.
Nominal Mass (required numeric entry)	The nominal mass value of the mass in kilogram [kg]. This value can help recognize the mass when used as most mass sets includes a number of masses with the same nominal value but different true mass values. The nominal value identifies the mass; the **<True Mass>** value is actually used to calculate the total mass load and the pressure output.
True Mass (required numeric entry)	The true mass value of the mass in kilogram [kg].
Tolerance (required numeric entry)	The tolerance of the **<True Mass>** entry in milligram [mg]. The tolerance value is used in calculating the uncertainty in the final output pressure.
Makeup Mass (check box)	Check this box to designate a mass as a makeup mass. There can be only one makeup mass in a mass set.
Mass Density (required numeric entry)	The density of all masses in the mass set. The value must be entered in kilogram per cubic meter [kg/m^3] and must be the same for all the masses in the set. The value is used for air buoyancy corrections, when applicable, when solving the pressure equation.
Mass Set Resolution (required drop down list selection)	The resolution with which mass values are entered in the <Mass> field stored in the **<Individual Masses>** list. The resolution option is necessary to avoid rounding and truncating errors when determining target pressures given a mass load using the **<Piston Gauge Calculator>**.
Total Mass (numeric display)	Displays the total mass in the Mass Set in kilogram [kg]. This is the sum of the mass of all the masses in the mass set.

11.4.3.2 PISTON GAUGE TRIM MASS TYPE MASS SET

When the Mass Set Type specified on the **Mass Set Editor**, **[Header]** tab is Piston Gauge Trim Mass, the **mass Set Editor**, **[Mass Set]** tab displays the fields listed below. The Mass Set **[Mass Set]** tab provides the true mass of the trim mass set and the mass set's resolution (smallest mass). Trim mass sets are used by Piston Gauge Type Piston Gauge Platforms, in combination with a piston-cylinder and a mass set. The trim mass set is used to load specific mass values more precisely than is possible using just the masses in the mass set.

Errors in values entered into the Mass Set [Mass Set] tab directly impact the calculation of Piston-Gauge pressure when the Mass Set is used. Typically, a pressure span error results. Make sure that all values are entered in the proper unit of measure.

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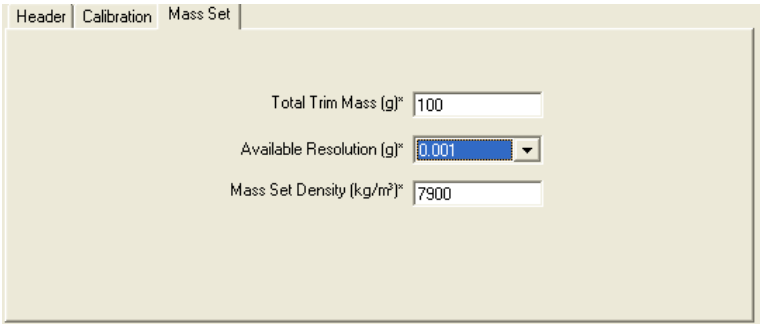

Figure 115. Mass Set Editor, Piston Gauge Trim Mass Type **[Mass Set]** Tab

Table 49. Mass Set Editor, Piston Gauge Trim Mass Type **[Mass Set]** Tab Fields

FEATURE	DESCRIPTION
Total Trim Mass (optional numeric entry)	The total of all the mass in the trim mass set. The value must be entered in grams, [g].
Mass Set Resolution (required drop down list selection)	The smallest mass increment available in the trim Mass Set. The values must be entered in grams, [g].
Mass Density (required numeric entry)	The density of all masses in the trim mass set. The value must be entered in kilograms per cubic meter [kg/m^3]. The value is used for air buoyancy corrections, when applicable, when solving the pressure equation.

11.4.3.3 DEAWEIGHT TESTER TYPE MASS SET

When the Mass Set Type specified on the **Mass Set Editor**, **[Header]** tab is Deadweight Tester, the **mass Set Editor**, **[Mass Set]** tab displays the fields listed below. The Mass Set **[Mass Set]** tab provides the mass label and corresponding pressure for each individual mass in the mass set. Each mass selection in the **<Individual Masses>** list updates the specific mass's information on the right side of the tab. Entries that have an asterisk ("*") next to them are required. When determining pressure for a Deadweight Tester type Piston Gauge Platform, the corresponding pressure of all masses and the Piston-Cylinder are summed and corrected for differences in gravity to yield the final pressure.

Errors in values entered into the Mass Set [Mass Set] tab directly impact the calculation of Piston-Gauge pressure when the Mass Set is used. Typically, a pressure span error results. Make sure that all values are entered in the proper unit of measure.

The information on the bottom right of the tab applies to all masses in the <Individual Masses> list. Select a mass in the <Individual Masses> list to view information specific to that mass. Changes to each mass must be saved prior to using the inset Editor Toolbar.

For Deadweight Tester Type Mass Sets, the mass bell or carriage must be set up as an individual mass of the Mass Set. For Piston Gauge Type Mass Sets, mass carrying bells have their own setup.

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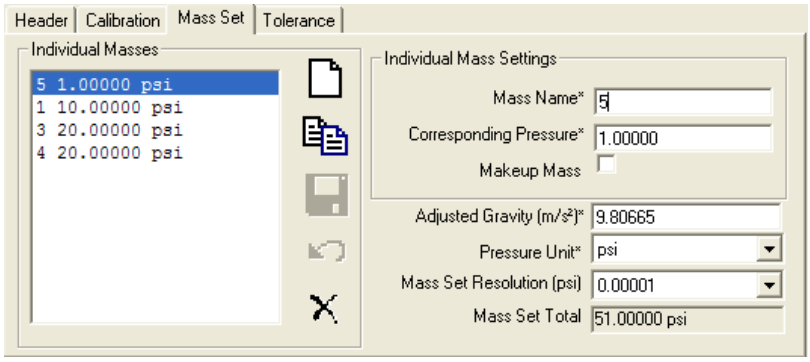

Figure 116. Mass Set Editor, Deadweight Tester Type **[Mass Set]** Tab

Table 50. Mass Set Editor, Deadweight Tester Type **[Mass Set]** Tab Fields

FEATURE	DESCRIPTION
Mass Name (optional numeric entry)	An easily identifiable description of an individual mass. When masses are used in operation, they are listed and need to be recognized by the value entered in this field and their **<Corresponding Pressure>** values. Typically, the label used is a mass number and nominal pressure value.
Corresponding Pressure (required numeric entry)	The pressure that results when a specific mass is floated at the gravity specified in **<Gravity>**. The value must be entered in the selected **<Pressure Unit>**.
Gravity (required numeric entry)	The gravity at which the pressure associated with each mass is correct. This is sometimes known as the "mass set gravity" or the "Deadweight tester gravity". The value must be entered in meters per second squared [**m/s^2**]. **COMPASS** uses the ratio of this gravity to the **<Local Gravity>** value specified in [**Options]** to calculate the pressure value of each mass when the Deadweight tester is used at **<Local Gravity>**.
Pressure Unit (required drop down list)	The pressure unit of measure to associate in which the **<Corresponding Pressure>** entry is expressed. Use the **Unit of Measure Converter** if needed.
Mass Set Resolution (required drop down list selection)	The resolution with which pressure values are entered in the **<Mass>** field stored in the **<Individual Masses>** list. The resolution option is necessary to avoid rounding and truncating errors when determining target pressures given a mass load using the **<Piston Gauge Calculator>**.
Total Pressure (numeric display)	Displays the sum of the corresponding pressures of all the masses in the Mass Set in the selected **<Pressure Unit>**.

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11.5 [MASS BELL]

The **Mass Set Editor** provides features to create, edit and remove Mass Bells that are used with Piston Gauge Type Piston Gauge Platforms by **COMPASS**. Use the **Main Toolbar** shortcut or **[Setup]**, **[Piston Gauge]**, **[Mass Bell]** to access the **Mass Bell Editor**.

Information on metrological elements (piston-cylinders and masses) entered in DHI PG7000 piston gauges can be extracted into COMPASS using the PG7000 Setup Extractor (see section 17). This avoids having to manually enter existing Piston-Cylinder information.

A Mass Bell setup in COMPASS is not necessary when direct remote pressure access of a DHI PG7000 is used with the <Autodetect Setup> option (see 4.3.3, [Header] Tab). The remote pressure output of the PG is fully compensated for all conditions and is not modified by COMPASS. Features are provided during test initialization to pick the current Mass Set setup inside the PG7000.

A Mass Bell setup is required for a Piston Gauge Type Piston Gauge Platform to be used in **COMPASS**. For Deadweight Tester Type Platforms the Mass Bell is included in the Mass Set. The information on the **[Mass Bell]** tab of the **Mass Bell Editor** define the true mass and density of the mass bell so the this information is available to **COMPASS** to calculate the complete mass load on the piston and the resulting final output pressure

After a Mass Bell is defined, future changes using the editor are required only for maintenance purposes. For this reason and due to the critical metrological impact errors in Mass Bell can cause, restricting user access to the **Mass Bell Editor** is highly recommended. Administrative users can assign user rights with **[Database]**,**[Users]** (24.3, [Database], [Users]).

Edit Mass Bells by selecting the appropriate tab and editing the necessary information. Press the **[Save]** option on the main **Editor Toolbar** to save all changes to the setup.

11.5.1 [HEADER] TAB

See section 4.3.3, [Header] Tab.

11.5.2 [CALIBRATION] TAB

See section 4.3.4, [Calibration] Tab.

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11.5.3 [MASS BELL] TAB

The **[Mass Bell]** tab provides fields to define the metrological characteristics of a Mass Bell. Entries that have an asterisk ("*") next to them are required.

Refer to section 29.8, Piston Gauge Pressure Calculations for details on how the fields on the [Mass Bell] tab are used to solve the pressure equation.

Errors associated with the values entered directly impact the calculation of Piston Gauge pressure when the selected Mass Bell is used.

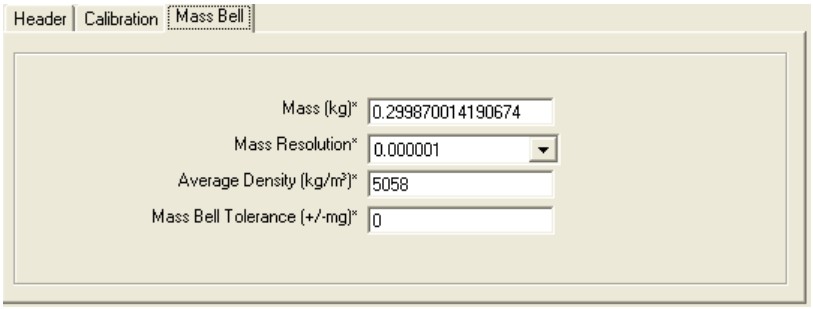

Figure 117. Mass Bell Editor, **[Mass Bell]** Tab

Table 51. Mass Bell Editor, **[Mass Bell]** Tab Fields

FEATURE	DESCRIPTION
Mass (required numeric entry)	The true mass of the Mass Bell in kilogram [kg].
Mass Resolution (required drop down list selection)	The resolution with which the mass value is entered in the **<Mass>** field. The resolution option is necessary to avoid rounding and truncating errors when determining target pressures given a mass load using the **<Piston Gauge Calculator>**.
Average Density (required numeric entry)	The average or apparent density of the Mass Bell. The value must be entered in kilogram per cubic meter [kg/m^3].
Mass Bell Tolerance (required numeric entry field)	The tolerance of the **<True Mass>** entry in milligram [mg]. The tolerance value is used in calculating the uncertainty of the final output pressure.

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11.6 DHI PG7000

DHI PG7000s must be setup using the **Piston Gauge Platform Editor**. There are two ways to define a **DHI** Piston Gauge.

The first method of defining a **DHI** Piston Gauge is to setup the PG7000 so that its on-board pressure calculation capabilities, using its active setup (see the PG7000 Operation and Maintenance Manual) are used and **COMPASS** reads the PG7000's pressure and mass outputs. To use this method check the **<Auto Detect Setup>** option on the **Piston Gauge Platform Editor**, **[Header]** tab and enter the proper remote communications settings of the Piston Gauge on the **[Communications]** tab (see 11.2, [Piston Gauge Platform]). All piston-cylinder and mass set information storage and pressure calculations are handled by the PG7000. **COMPASS** simply reads the available selections and provides choices for the test operator. During Test Execution, **COMPASS** sends the new set point information to the PG7000 and reads the required mass load. The operator is prompted to load the mass returned by the PG7000 remote interface and respond to the message when the pressure is generated. This is a remote interpretation of the process used to set pressure by accessing the PG Terminal. This is recommended for users that do not share metrological elements between multiple PG7000 platforms.

DHI PG7000s can be set up two ways. One uses the PG7000's on-board metrological element storage and pressure calculations. In the second, metrological elements are stored in the COMPASS database and calculations are handled by COMPASS. Examples of both PG7000 setup methods are available in the COMPASS database. Use the [Find Previous Setup] option to locate an example (see 4.3.3, [Header] Tab).

The second setup method is recommended for users that share metrological elements between platforms. In this method, piston-cylinders, mass sets and mass bells are stored once in **COMPASS** database rather than in each individual PG7000 platform. **COMPASS** calculates pressures and mass loads. Piston position, rotation and other ambient condition measurements provided by the Piston Gauge are defined as individual final outputs when the platform is defined. To use this method follow the steps below:

❶ If the PG7000 piston-cylinder, mass set and mass bell information is loaded in PG7000, it must be extracted from the PG7000 into the **COMPASS** database using the **PG7000 Setup Extractor**. If not, the metrological elements must be set up using the **Piston-Cylinder**, **Mass Set** and **Mass Bell Editors**.

❷ Setup the PG7000 Piston Gauge Platform without the **<Auto Detect Setup>** option checked and define the remote interface settings on the **[Communications]** tab.

❸ Use the **[Output]** tab to set up final outputs for ambient pressure, ambient temperature, ambient humidity, piston position, piston rotation and reference vacuum, if available.

❹ Save the Piston Gauge Platform information using the **Editor Toolbar**, **[Save]** icon. This updates the list of available final outputs for selection in the next step.

❺ Select the **[Sources]** tab and choose the PG7000 being setup as the source for the **<Platform Conditions Sources>**.

❻ Select the **[P-C/MS]** tab and define which metrological elements are supported by the Piston Gauge. All elements whose characteristics have been extracted from **COMPASS** using the **PG7000 Setup Extractor** will be in the **COMPASS** database available for selection.

Again, use the **Editor toolbar**, **[Save]** icon to save the PG7000. The setup is complete.

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NOTES

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12. [SETUP], [DEFAULT HARDWARE CONFIGURATION]

12.1 OVERVIEW

The **Default Hardware Configuration** is accessed using **[Setup]**, **[Default Hardware Configuration]**. The choices made on this form specify the default data acquisition and control hardware that **COMPASS** uses to accomplish specific data acquisition and control tasks. Task are organized by measurement and set functions that correspond to device final outputs and final sets. The actual measurement and control devices to use can be modified during Test Initialization if desired.

The actual test measurement and control devices are specified in the Test Initialization. Choices made on Default Hardware Configuration form can reduce the number of device selections required to initialize a test. This makes it possible to use the [Finish] initialization option to reduce initialization time (see 7.3, Test Initialization).

The list of choices available as source for each final output or final set in the Default Hardware Configuration includes all the devices that have set up and stored in the **COMPASS** database as sources for that output or set. The DUT Editor, Support Device Definition Editor, and the Piston Gauge Platform Editor each have features to define final outputs and/or sets. Any device in **COMPASS** can support multiple final outputs and/or sets.

See Section 3.3, Device (instrument) Support Concept, to get a thorough understanding of how COMPASS handles devices and final outputs. In general, the Final Output selection of any support device determines how the device can be used in COMPASS.

Specify default source devices on each of the tab of the Default Hardware Configuration. If an option is not used, select **<None>**. The following sections detail the features on the Default Hardware Configuration tabs.

12.2 [ENVIRONMENT] TAB

The **[Environment]** tab specifies the devices to use to measure and control reference pressure and temperature and measure the ambient conditions.

The fields of the **[Environmental]** tab are described in table below.

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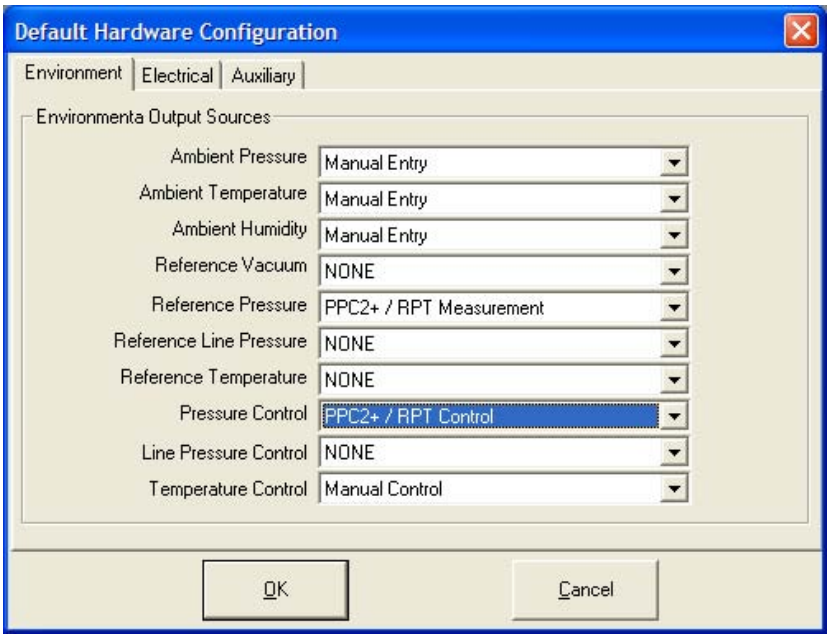

Figure 118. Default Hardware Configuration, **[Environment]** Tab

Table 52. Default Hardware Configuration, **[Environment]** Tab Fields

OUTPUT/SET TYPE	OUTPUT/SET SOURCE CHOICES
Ambient Pressure	The list includes all devices setup with a final output of **Ambient Pressure** or **General Pressure**. Select the default ambient pressure source device.
Ambient Temperature	The list includes all devices setup with a final output of **Ambient Temperature** or **General Temperature**. Select the default ambient temperature source device.
Ambient Humidity	The list includes all devices setup with a final output of **Ambient Humidity**. Select the default ambient humidity source device.
Reference Vacuum	The list includes all devices setup with a final output of **Reference Vacuum** or **General Pressure**. Select the default reference vacuum source device.
Reference Pressure	The list includes all devices setup with a final output of **Reference Pressure** or **General Pressure**. Select the default reference pressure source device. This selection does not have to change to use a different pressure reference when running a test. A reference pressure source device selection may be made during Test Initialization The reference pressure is compared to the DUT pressure during tests.
Reference Line Pressure	The list includes all devices setup with a final output of **Line Pressure** or **General Pressure**. Select the default reference line pressure source device.
Reference Temperature	The list includes all devices setup with a final output of **Reference Temperature** or **General Temperature**. Select the default reference temperature source device.
Pressure Control	The list includes all devices setup with a final set of **Test Pressure Control** or **General Pressure Control**. Select the default reference pressure controller.
Line Pressure Control	The list includes all devices setup with a final set of **Line Pressure Control** or **General Pressure Control**. Select the default line pressure controller.
Temperature Control	The list includes all devices setup with a final set of **Temperature Control**. Select the default test temperature controller.

12.3 [ELECTRICAL] TAB

The **[Electrical]** tab specifies the devices to use to measure raw electrical outputs from DUT, references and other support devices.

The fields of the **[Electrical]** tab are described in table below.

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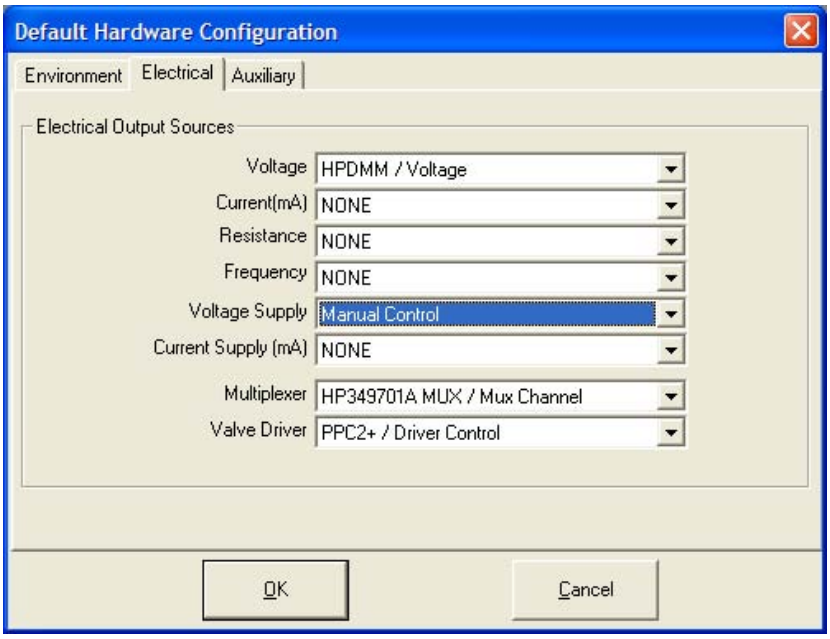

Figure 119. Default Hardware Configuration, **[Electrical]** Tab

Table 53. Default Hardware Configuration, **[Electrical]** Tab Fields

OUTPUT/SET TYPE	OUTPUT/SET SOURCE CHOICES
Voltage	The list includes all devices setup with a final output of **Voltage Measurement**. Select the default voltage measurement source device.
Current (mA)	The list includes all devices with a final output of **Current Measurement**. Select the default current measurement source device.
Resistance	The list includes all devices with final output of **Resistance Measurement**. Select the default resistance measurement source device.
Frequency	The list includes all devices with final output of **Frequency Measurement**. Select the default frequency measurement source device.
Voltage Supply	The list includes all devices with final set of **Voltage Supply**. Select the default voltage controller.
Current Supply	The list includes all devices with a final set of **Current Supply**. Select the default current controller.
Multiplexer	The list includes all devices with a final set of **Multiplexer Channel**. Select the default multiplexer.
Valve Driver	The list includes all devices with a final set of **Valve Driver Control**. Select the default valve driver controller.

12.4 [AUXILIARY] TAB

The **[Auxiliary]** tab specifies the devices to use for auxiliary measurement. An auxiliary output is the output of a device that is not used for any specific **COMPASS** function. Any type of final output can be designated as an auxiliary output. Therefore, all devices setup in **COMPASS** are available for selection in each auxiliary device dropdown list. Up to 10 individual auxiliary outputs can be used. Measureands already used in other parts of **COMPASS** can also be used as Auxiliary Sources.

An output already used by COMPASS cannot be used as an auxiliary data source. Typically the output of a device is logged to the Data File automatically (see 14.9, [Data In File] Tab). Selecting the output as an auxiliary data source would yield redundant data.

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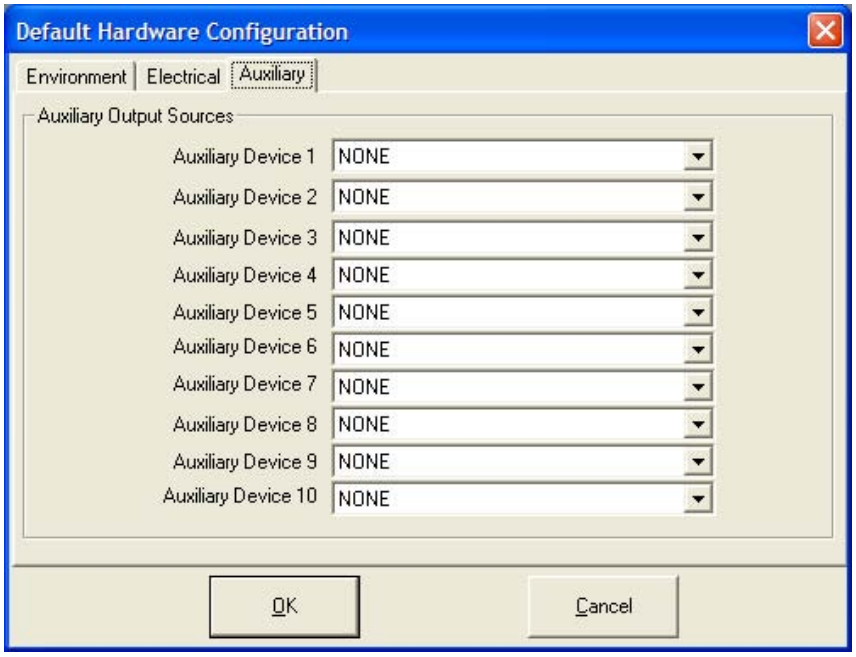

Figure 120. Default Hardware Configuration **[Auxiliary]** Tab

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13. [SETUP], [PRESSURE MEDIA]

The **Pressure Media Editor** provides features to create, edit and remove pressure media that used by **COMPASS** in calculating fluid head Corrections. Access the Pressure Medium Editor using **[Setup]**,**[Pressure Media]**.

DHI products defined with the <Auto Detect Setup> option do not use the pressure media information defined in COMPASS to perform pressure head corrections. During Test Initialization, COMPASS sends remote commands to the device to set the selected pressure medium and head height. All head corrections are performed internally to the product. Refer to the device's Operation and Maintenance Manual for details on head corrections.

Pressure media are used by **COMPASS** to fluid head corrections for pressure reference devices. A head correction is required when the pressure reference level of a reference device is not the same as the reference level of the DUT. In many cases the error associated with not performing a head correction is insignificant. As a result, pressure head corrections are not always necessary. To include a pressure head correction, specify a **<Head Height>** and a pressure **<Medium>** during Test Initialization. When the head height is not zero, an **<H>** appear next to the reference pressure when running tests to indicate that a head correction is active (see 5.5.4, Device Output Run Screen). Refer to section 29.9, fluid heads, for details on pressure head calculations.

There are two types of pressure media. The first uses a constant value for density and the second uses density that changes with the current ambient conditions. Only pressure media supported by the **DHI Unit of Measure Converter** can use a non-fixed density. These media use the **<Dynamic Density Compensation>** option. When selected, the **<Density>** field is disabled. **COMPASS** will calculate the density based on the current ambient conditions. When the field is not selected, the **<Density>** value entered is directly used without manipulation.

To edit a pressure medium, use the features on the **<Editor** toolbar to copy or create a new pressure medium. Select or enter a **<Medium Label>**. The **Unit of Measure Converter** supports most items in the list. These media can use the **<Dynamic Density Compensation>** option. This feature is enabled only when a **COMPASS** supported medium is selected. When available, it is desirable to use this feature as it results in the most accurate density value. The ability to use a constant density value is still provided.

The table below describes the features of the **Pressure Media Editor**.

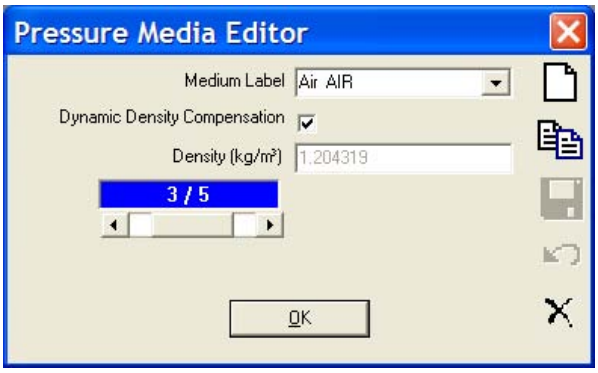

Figure 121. Pressure Media Editor

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Table 54. Pressure Media Editor Fields

FEATURE	DESCRIPTION
Medium Label (required drop down list selection)	Select or enter a pressure medium label. Many pressure media included in the list support the **Dynamic Density Compensation** option. The pressure medium is selected during Test Initialization using the value entered in this field.
Dynamic Density Compensation (optional check box)	Check this box to allow **COMPASS** to determine density as a function of the current pressure and temperature. Only pressure media directly supported by the **Unit of Measure Converter** support this selection. These media are in the list of **<Medium Labels>**.
Density **(**conditional numeric entry**)**	Enter the constant density to use for pressure head corrections in kilogram per cubic meter [kg/m^3]. An entry is only required when the **<Dynamic Density Compensation>** option is not selected.

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14. [TOOLS], [OPTIONS]

14.1 OVERVIEW

The **COMPASS [Options]** dialog is accessed using **[Tools]**, **[Options]**. Selections on this form are used to adjust a variety of **COMPASS** operational preferences. The **COMPASS [Options]** dialog is organized into individual tabs that organize preferences in to specific aspects of **COMPASS** operation. The following sections detail the options on each tab.

14.2 [AMBIENT CONDITIONS] TAB

The **[Tools]**, **[Options]**, **[Ambient Conditions]** tab is used to specify default conditions and unit of measure to use when running tests.

The purpose of the **[Ambient Conditions]** tab fields and settings as well as instructions on how to use them are provided in **Table 55**. When selections are complete, click **[OK]** to save changes or select another tab to change other options.

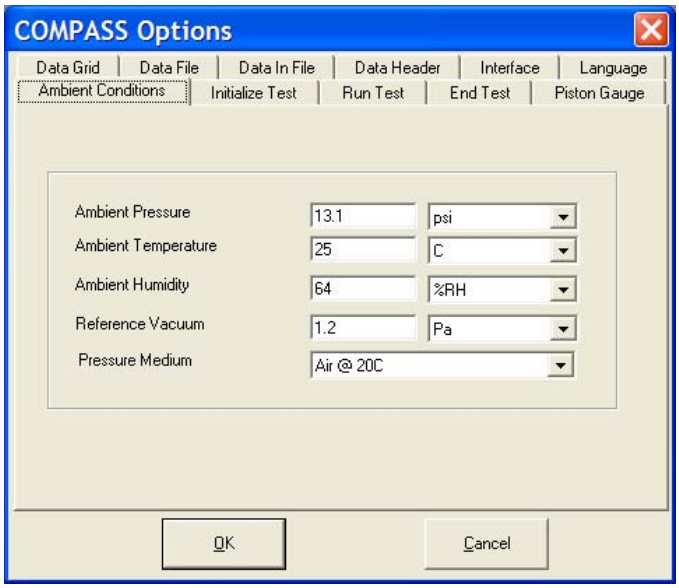

Figure 122. Options, **[Ambient Conditions]** Tab

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Table 55. COMPASS Options, **[Ambient Conditions]** Tab Sélections

FEATURE	DESCRIPTION
Ambient Pressure (numeric entry)	Enter the default ambient pressure value and select the corresponding unit of measure. When running tests, if ambient pressure is entered manually, the value specified is used by default.
Ambient Temperature (numeric entry)	Enter the default ambient temperature value and select the corresponding unit of measure. When running tests, if ambient temperature is entered manually, the value specified is used by default.
Ambient Humidity (numeric entry)	Enter the default ambient humidity value and select the corresponding unit of measure. When running tests, if ambient humidity is entered manually, the value specified is used by default.
Reference Vacuum (numeric entry)	Enter the default value of residual pressure under a piston gauge bell jar in absolute measurement mode. When running tests, if reference vacuum is entered manually, the value specified is used by default.
Pressure Medium (drop down list box)	Determines the default pressure medium to use for head corrections. The actual selection is made during Test Initialization when a reference pressure measuring device is initialized. Pressure media are created using the **<Pressure Media Editor>**.

14.3 [INITIALIZE TEST] TAB

The **[Tools]**, **[Options]**, **[Initialize Test]** tab is used to set user preferences affecting the initialization portion of test execution (see 7.3, Test Initialization). The test initialization steps can be adjusted to avoid repeating undesired or unnecessary warnings and selections.

The purpose of the **[Initialize Test]** tab fields and settings as well as instructions on how to use them are provided in **Table 56**. When selections are complete, click **[OK]** to save changes or select another tab to change other options.

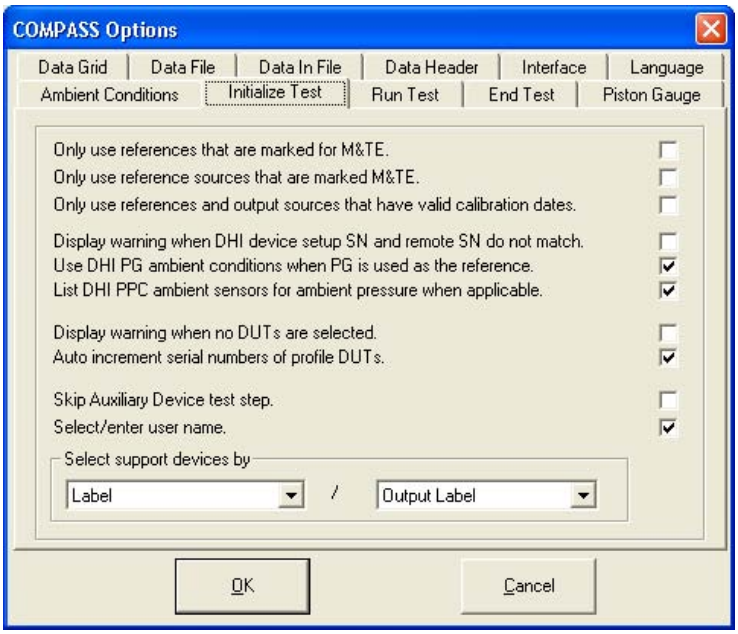
COMPASS Options
Data Grid
Data File
Data In File
Data Header
Interface
Language
Ambient Conditions
Initialize Test
Run Test
End Test
Piston Gauge
Only use references that are marked for M&TE.
Only use reference sources that are marked M&TE.
Only use references and output sources that have valid calibration dates.
Display warning when DHI device setup SN and remote SN do not match.
Use DHI PG ambient conditions when PG is used as the reference.
List DHI PPC ambient sensors for ambient pressure when applicable.
Display warning when no DUTs are selected.
Auto increment serial numbers of profile DUTs.
Skip Auxiliary Device test step.
Select/enter user name.
Select support devices by
Label
/
Output Label
OK
Cancel

Figure 123. Options, **[Initialize Test]** Tab

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Table 56. Options, **[Initialize Test]** Tab Fields

FEATURE	DESCRIPTION
Only use references that are marked M&TE (check box)	Check this option to prevent pressure and temperature references that are not specified as M&TE from being selected during test initialization.
Only use reference sources that are marked M&TE (check box)	Check this option to prevent reference support instruments that are not marked as M&TE from being selected during test initialization. This includes, DMMs, piston-cylinders, mass sets, mass bells, and reference vacuum devices.
Only use reference and output sources that have valid calibration dates (check box)	Check this option to limit references and output sources to instruments that have valid calibration dates. That is, the date of the test is between the defined calibration date and the calibration due date (see 4.3.4).
Display warning when DHI device setup SN and remote SN do not match (check box)	The serial number of a DH Instruments device that has the **<Auto Detect>** setup option enabled (see 4.3.3, [Header] Tab) is automatically read during test initialization. This serial number is automatically compared to the serial number of specified in the device definition. If this option is checked, a warning message displays when the serial numbers do not match. This is an easy way to help guarantee that the proper instruments are used during tests. Do not check this option if the serial number specified for DH instruments products includes information other than the serial number of the device.
Use DHI PG ambient conditions when PG is used as the reference (check box)	Check this option to use the ambient pressure, temperature and humidity outputs of a DH Instruments PG7000 when it is used as the pressure reference. Checking this option prevents the manual selection of these ambient sources.
List DHI PPC ambient sensors for ambient pressure when applicable. (check box)	Some DHI pressure controllers have a built in ambient pressure sensor. Check this box to list these sensors amongst the ambient pressure devices. If this option is not checked, only the main RPT of the controller will be listed amongst the ambient pressure devices.
Display warning when no DUT is selected (check box)	A test initialization warning message displays when no DUTs are selected in Run Test and Run Manual test modes when this options is selected.
Auto increment serial number of profile DUTs (check box)	Check this box to allow automatic entry of the DUT serial number for profile DUTs. The serial number of the first DUT setup is incremented to create the DUT of the second DUT. If the DUT is not a profile or the serial numbers are not sequential, do not use this option.
Skip Auxiliary Device test setup (check box)	Check this option to skip the selection of auxiliary data devices during test initialization. If a Test Definition contains auxiliary devices, the test initialization step is not skipped.
Select/enter user name (check box)	When checked, the user name can be changed during Test Initialization. Otherwise, the active user login determines the user name for any given test.
Select support devices by (check box)	Select the device header fields to use to list devices. Any two of the following fields can be used in any order: **Label**, **Manufacturer**, **Model**, **Serial Number**, **Identification**, **Customer ID**, and **Final Output Label**. Field 1 / Field 2. All device lists in the **COMPASS** will display devices according to the format selected. It is best to use unique characteristics of a device to allow easy selection. In most cases, the **Label** should be used in the first position.

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14.4 [RUN TEST] TAB

The **[Tools]**, **[Options]**, **[Run Test]** tab is used to set user preferences affecting the run test part of test execution. Various aspects of run test behavior can be changed using this feature. When selections are complete, click **[OK]** to save changes or select another tab to change other options.

The purpose of the **[Run Test]** tab fields and settings as well as instructions on how to use them are provided in **Table 57**.

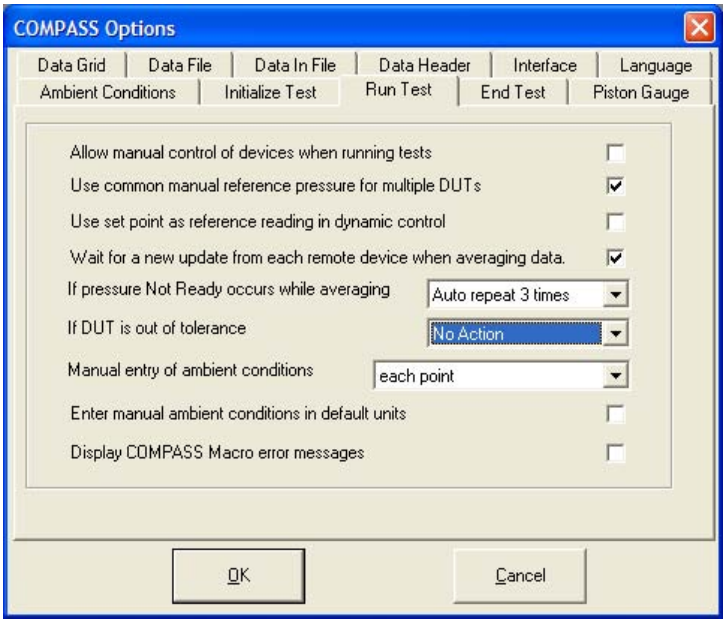

Figure 124. Options, **[Run Test]** Tab

Table 57. Options, **[Run Test]** Tab Fields

FEATURE	DESCRIPTION
Allow manual control of devices when running (check box)	Check this box to allow user access to the target controls of the **<Conditions>** and individual device Run Screens during tests. The target controls allow new pressure and temperature targets to be set and direct adjustment of valve driver states. Using these controls during a test can alter the sequence defined by the Test Definition.
Use common manual reference for multiple DUTs (check box)	Affects how reference readings are taken when reference readings are entered manually and multiple DUTs are being tested. If the box is checked, at each test point a single reference pressure entry will be used as the common reference reading for all the DUTs. If the box is not checked, an individual reference reading must be entered for each DUT. This setting has no effect if the reference device is read remotely and/or the test is not a multiple DUT test.
Use set point as reference reading in dynamic control (check box)	When a **DHI** PPC is the pressure controller and the Test Definition specifies Dynamic pressure control, the target pressure is used as the reference pressure when this option is checked.

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FEATURE	DESCRIPTION
Wait for a new update from each remote device when averaging. (check box)	Check this option to force a new update from all remote instruments when averaging test data. **COMPASS** will not complete the averaging process until every instrument that has a remote interface outputs a least one new value. This prevents the need to increase the averaging time of a test when using instruments that have a slower remote interface. When this option is not checked, **COMPASS** averages as many samples as possible during the specified averaging time. However, this may result in no new data samples in some devices. If there are no new data samples, the data logged to the data file will be the last valid output of these devices. When instantaneous points are logged in a Manual Test or the averaging time is 0, this option has no effect on data acquisition.
If pressure Not Ready occurs while averaging (dropdown selection list)	Determines what action to take if a *Not Ready* condition occurs while reading and averaging data at a test point. In all cases, an **<R>** is logged in the test Data File for the point whenever a *Not Ready* condition occurred while averaging test data and the point was not repeated (see 3.3.5.3). This feature has no effect if the reference is not set up for remote communication. The options are: **<No Action>** — An **<R>** displays in the **<Status>** column of the test Data File but there are no associated prompts or messages during the test. The test continues normally. **<Prompt to repeat>** — A message allowing the point to be repeated or to continue with data collection displays if a *Not Ready* condition occurred. A repeated point begins with the set pressure step of the test. Do not use this selection when running automated, unattended tests as **COMPASS** will wait indefinitely for a response to the prompt, causing the test to hang. **<Auto repeat 3 times>** — The test set pressure step is automatically repeated up to 3 times when a *Not Ready* condition occurs during averaging. This selection can be used when running automated, unattended tests as the test will proceed. This selection is intended for use with fully automated pressure controllers (PPCx). If a PG7000 reference is used, automatically repeating the point may appear to be the next test point. This can be confusing to the test user. The test point is repeated a maximum of 3 times regardless of other test related auto repeat options. **<Wait for Ready>** — When a Not Ready occurs, test averaging is suspended and the test defined stability criteria are used to wait for a Ready condition before continuing with the average. All stability criteria are imposed in the same fashion as when setting a target. The control timeout is the maximum possible delay when waiting for a Ready state. Averaging continues when the target output is Ready or when a stability time-out occurs. If a time-out occurs, no more wait for ready operations will apply for the current averaging cycle. Otherwise, there is no limit to the number of times a wait for ready event will occur for a single averaging cycle. Each time a Not Ready state is determined, any averaging data collected within 2s of the Not Ready is discarded. This option was designed for use with the AMH PG7000 automatic piston gauge system.

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FEATURE	DESCRIPTION
If DUT is out of tolerance (dropdown selection list)	Determines what action to take if any of the DUTs is out of tolerance according to its tolerance specification while averaging data for a test point. *A* **<T>** is logged in the test Data File whenever a DUT is out of tolerance. The **DUT/Reference Comparison Run Screen** displays a red triangle next to all DUTs that are out of tolerance (see **DUT/Reference Comparison Run screen**, 5.5.2). The options are: **<No Action>** — A **<T>** displays in the **<Status>** column of the test Data File but there are no associated prompts or messages during the test. The test continues normally. This is the default selection. **<Prompt to repeat>** — A message allowing the point to be repeated or to continue with data collection displays if an out of tolerance condition occurs. A repeated point begins with the set pressure step of the test. Do not use this selection when running automated, unattended tests, as **COMPASS** will wait indefinitely for a response to the prompt, causing the test to hang. **<Auto repeat 3 times>** — The test set pressure step is automatically repeated up to 3 times when an out of tolerance condition occurs during averaging. This selection can be used when running automated, unattended tests as the test will proceed. This selection is intended for use with fully automated tests. The test point is repeated a maximum of 3 times regardless of other test related auto repeat options.
Manual entry of ambient conditions (drop down list box)	Determines when manual ambient conditions information entries will be made in the test sequence. When the reference or DUT is a Piston Gauge, the selections here have no impact. The Piston Gauge pressure automatically requires the entry of the ambient information on the **Piston Gauge Calculator**. There are three possible choices: **First Point** — Entry of ambient conditions is prompted only at the first point of the test. No more entries are requested after the first point and the values entered are used for all the points. **Every Point** — Entry of ambient conditions is prompted at each point in the test. The values entered at each point are used for the point. **Use Default Value** — There is no prompt for entry of ambient conditions. The default conditions specified on the **[Options]**, **[Ambient Conditions]** tab are used.
Enter manual ambient conditions in default units. (check box)	When a manual entry ambient pressure, temperature or humidity device is used, the output may be entered in the raw output unit of the device or the unit specified on the **[Ambient Conditions]** tab. When the selection of the device during test initialization is **<Manual Entry>**, the default units are used regardless of this selection.
Display COMPASS Macro error message. (check box)	Check this option to help debug **COMPASS** macros when running tests. If there is a macro error, a message box will display with the pertinent error information. At this the error can be ignored, or the macro can be debugged based on the response to the error message. If the macro is debugged, save the changes and close the editor to resume the test. The next time the macro is called, verify that the changes were successful. This technique will work for all macros except **GetCommand** type macros (see Macro Types, 18.5). *An error messages displays for each macro error. If there are many macro errors, it is best to abort the test and correct the problem. It is a good idea to update the COMPASS status bar within the macro to notify the test operator of any errors.*

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14.5 [END TEST] TAB

The **[Tools]**, **[Options], [End Test]** tab is used to set user preferences affecting operations that occur to conclude a test sequence (see 7.4, Run Test).

The purpose of the **[End Test]** tab fields and settings as well as instructions on how to use them are provided in **Table 58**. When selections are complete, click **[OK]** to save changes or select another tab to change other options.

Selecting a fixed repeat point delay, deactivating the test notes and enabling the auto report generation can allow an automated test to run and generate a complete report without any user intervention.

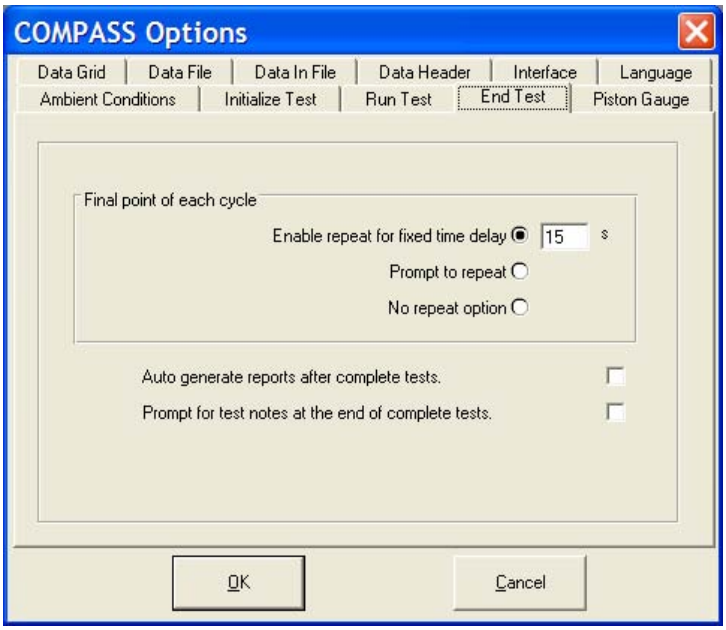

Figure 125. Options, **[End Test]** Tab

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Table 58. Options, **[End Test]** Tab Fields

FEATURE	DESCRIPTION
Final point of each cycle (radio button selection)	**COMPASS** provides the capability to repeat test points using the **Run Toolbar**, **[Back]** icon. However, if a test ends automatically after the last point, there is no opportunity to repeat points when the last point has completed. This option determines whether **COMPASS** will pause to allow points to be repeated after the last point is complete or automatically end the test without pause. There are three choices: **Enable repeat for fixed time delay** — After the last test point is complete, the test pauses for a fixed time delay. During the delay, the **Run Toolbar**, **[Back]** icon remains active allowing points to be repeated. This choice gives the possibility of repeating points after the last point is complete but also causes the test to eventually continue automatically without operator intervention. **Prompt to repeat** — Systematically pauses the test at the end of each test cycle and prompts the user to indicate whether the last test point should be repeated. This selection guarantees that the operator will consider whether to repeat points but it also prevents the test from completing automatically. **No repeat option** — The test will concludes automatically after the last point. There is no opportunity to repeat points after the last point is complete. Use this choice to prevent any delays or interruptions in the test sequence.
Auto generate report after complete tests (check box)	Check this option to automatically create a report when a test completes. The report is generated using the last report template used. The **<Test Complete>** options still display at the end of the test.
Prompt for test notes at the end of the test (check box)	If checked, **COMPASS** always prompts for test notes to be entered at the end of the test. The test notes prompt does not interfere with unattended tests. The prompt occurs after all test data is collected and the pressure is vented. Uncheck this option to avoid the test notes prompt. In this case, no test notes can be included in the test's Data File.

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14.6 [PISTON GAUGE] TAB

The **[Tools]**, **[Options], [Piston Gauge]** tab is used to set default preferences affecting Piston Gauges.

The purpose of the **[Piston Gauge]** tab fields and settings as well as instructions on how to use them are provided in the **Table 59**. When selections are complete, click **[OK]** to save changes or select another tab to change other options

The Local Gravity setting entered is used in all Piston Gauge calculations unless specifically changed in the Piston Gauge Calculator (see 16, [Tools], [Piston Gauge Calculator]).

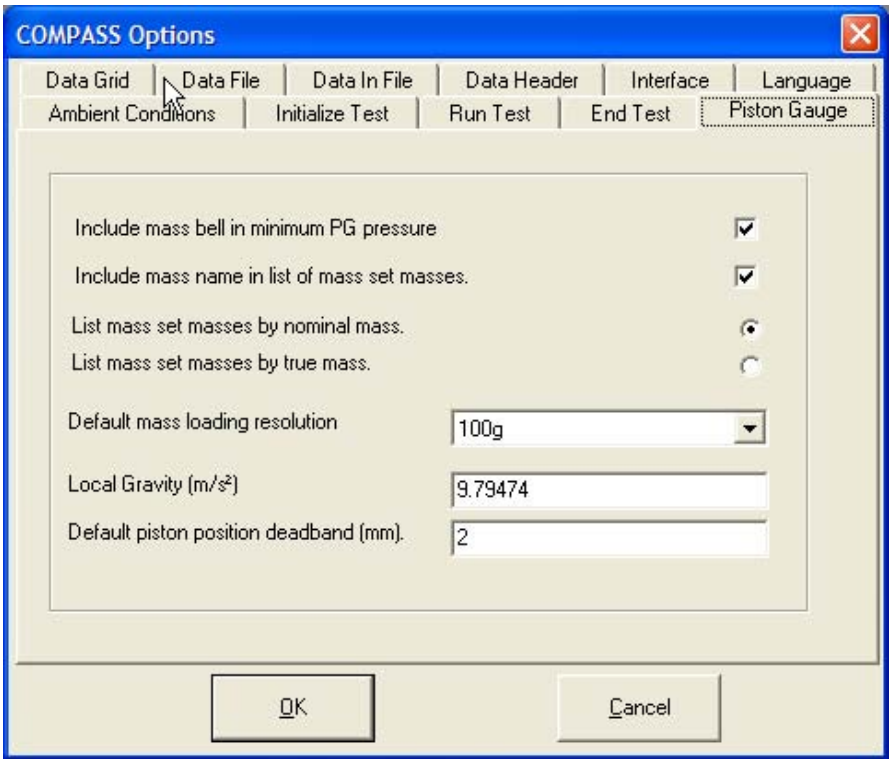

Figure 126. Options, **[Piston Gauge]** Tab

Table 59. Options, **[Piston Gauge]** Tab Fields

FEATURE	DESCRIPTION
Include mass bell in minimum PG Pressure (check box)	When checked, when the lowest possible pressure is specified as a piston gauge set point, the minimum mass load is assumed to be the piston + the mass bell. Check this box is you do not want to make measurement with the piston gauge piston only. In some cases this is required. For example, a PG7601 in absolute mode cannot engage rotation without the mass bell loaded.
Include mass name in list of mass set masses. (check box)	Check this option to display the user specified name of each individual mass set mass in all lists of mass set masses. The mass list displays in the **Mass Set Editor** and the **Piston Gauge Calculator** are altered by this selection. A mass name is not a required field for a mass set mass. As a result, it is possible that only the mass value will display as though this option were not checked.
List mass set masses by nominal mass (radio button)	Check this option to display the nominal mass of each individual mass set mass in all lists of mass set masses. The mass list displays in the **Mass Set Editor** and the **Piston Gauge Calculator** are altered by this selection. A nominal mass is not a required field for a mass set mass. As a result, it is possible that a nominal mass value will not be available. If this is the case, the true mass value is used.

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FEATURE	DESCRIPTION
List mass set masses by true mass (radio button)	Check this option to display the true mass of each individual mass set mass in all lists of mass set masses. The mass list displays in the **Mass Set Editor** and the **Piston Gauge Calculator** are altered by this selection.
Default mass loading resolution (list box)	Select the default minimum mass value to be included in mass loading commands. The actual value can be modified in the **Piston Gauge Calculator** when running a test.
Local Gravity (numeric entry)	Enter the acceleration due to gravity at the location in the piston gauge is used. The value entered in this field is used as the local gravity when running a test. The **<Local Gravity>** entry on the **Piston Gauge Calculator** is disabled when testing. This entry has no effect on **DHI** piston gauges setup using the **<Auto Detect Setup>** option. In this case, the piston gauge will use the gravity entered on the front panel.
Default piston position deadband (mm). (numeric entry)	This field represents the default piston position ready zone for piston gauges that use a remote piston position indicator. Test definitions that use a piston gauge as a reference support the entry of a test specific dead band value (see 8.6.7). When running a manual test, the value entered in this field is used to determine if the piston gauge is ready or not ready. This value does not affect DHI PG7000s setup with **<Autodetect Setup>** when running Manual Tests.

14.7 [DATA GRID] TAB

The **[Tools]**, **[Options]**, **[Grid]** tab is used to customize the **Data Grid Run Screen** that is available while running tests. The grid can be customized to display only the desired data field columns while suppressing other columns. The order of the columns can also be changed. Any test data item logged in the Data File can be included in any column of the Data Grid run screen by using the correct combination of features. Refer to section 21.5.3, DATA Table, for a listing of the fields available in the data grid. Press the **[Default Settings]** button to automatically display the **COMPASS** default data fields.

Instructions on the operation of the **[Grid]** tab are provided in **Table 60**. When selections are complete, click **[OK]** to save changes or select another tab to change other options.

Selections made on the [Grid] tab have no effect on the data that is logged to the Data File. The grid setup is provided for customization of the Data Grid Run Screen only (see 5.5.7, Data Grid Run screen). Use the [View Data File] option to view all columns of test data. Use the [Data In File] tab contains features to alter the actual data stored in the Test Data File.

Multiple grid display fields can be selected in two ways: a) hold down the SHIFT key and use the UP and/or DOWN arrow keys to make multiple contiguous selections; b) hold down the CTRL key and us the mouse to make multiple non-contiguous selections. Add or remove the selections by using the appropriate shift button.

Sort the <Columns in grid> display by selecting an item then using the UP or DOWN arrow keys while holding the CTRL button.

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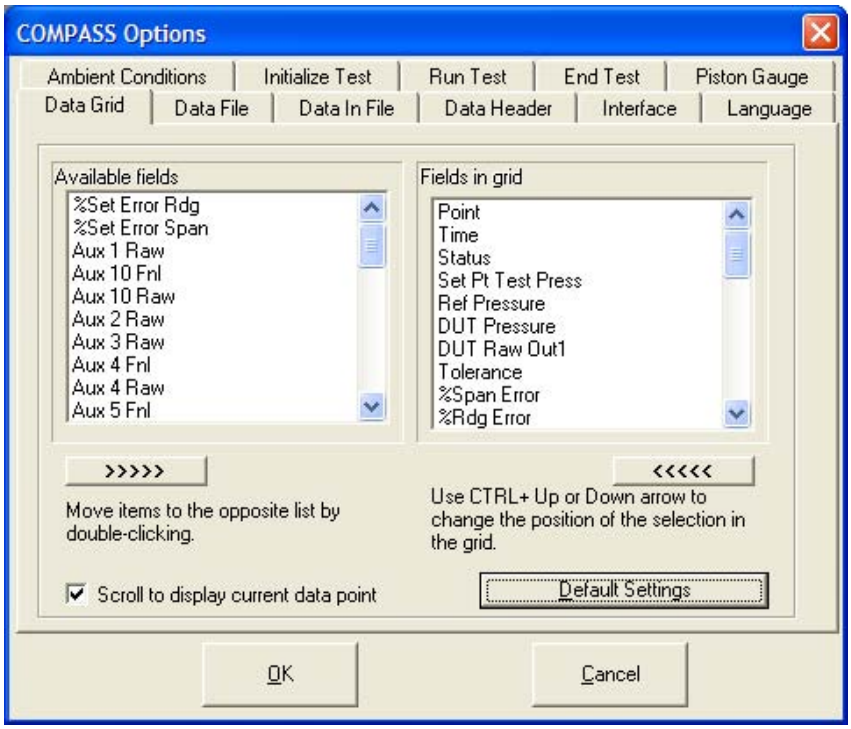

Figure 127. Options, **[Data Grid]** Tab

Table 60. Options, **[Data Grid]** Tab Selections

FEATURE	DESCRIPTION
Available fields (list box)	Contains an alphabetically sorted list of the data field columns not currently included in the **Data Grid Run Screen**. Individual fields can be dragged and dropped onto the **<Columns in grid>** list. Alternatively, multiple fields can be selected and moved by using combinations of the shift, arrow and control keys along with the shift right button **">>>>>>"**.
Fields in grid (list box)	These are the data field columns that display in the **Data Grid Run Screen** when a test is running. The **<Point>** field is always included and is always at the top of the list. All other data fields can be added, removed or arranged in any order. Double-click a field to remove it from the list. Alternatively, multiple fields can be selected and moved by using combinations of the shift, arrow and control keys along with the shift left button **"<<<<<"**. Move a field's position in the list by selecting the field then using the UP or DOWN arrow keys while holding the CTRL button.
Scroll to display current data point (check box)	When checked, the current data point is automatically displayed in the Data Grid run screen when **COMPASS** is in the **[Run Test]** mode. If the grid is scrolled between points, and a new point is taken, the grid automatically scrolls to the bottom to display the new point. The plot is also updated to force the display of the current point in the current test cycle even if the plot has been customized to not display the current cycle. Uncheck this box to avoid automatic forced updating of the **Data Grid** and **Plot Run Screens**.

14.8 [DATA FILE] TAB

The **[Tools]**, **[Options]**, **[Data File]** tab is used to set user preferences affecting the Data File (*.dat) which records the data from a test. See section 27, Data Files, for details on how data files are named and structured. Use the **[Database]**,**[Setup]** menu choice to store complete Data Files to the **COMPASS** Test Data Database.

The purpose of the **[Data File]** tab fields and settings as well as instructions on how to use them are provided in **Table 61**. When selections are complete, click **[OK]** to save changes or select another tab to change other options.

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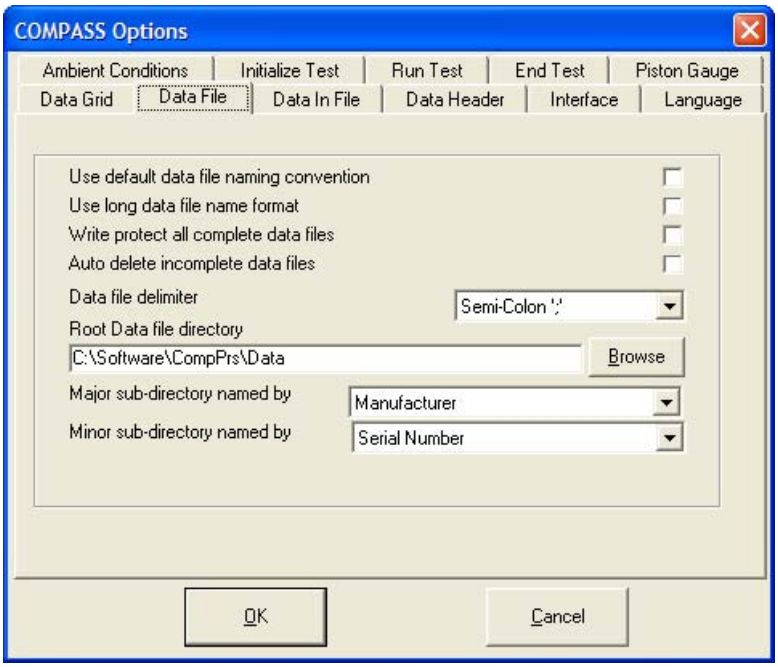

Figure 128. Options, **[Data File]** Tab

Table 61. Options, **[Data File]** Tab Fields

FEATURE	DESCRIPTION
Use default Data File naming convention (check box)	Check this option to automatically name new Data Files using the default Data File naming convention.
Use long Data File name format (check box)	Check this option to use the long Data File naming convention as described in. This feature is checked by default. Although **COMPASS** is a 32-bit Windows application, Data Files may be stored on a network or other location that does not support the long file naming convention. To avoid file name truncation, uncheck this option to create default file names that are 8 characters or less.
Write protect all complete Data Files (check box)	When this option is checked, test Data Files are write protected. Check this option to protect data gathered from completed tests. Write protected files are not easily modified, so this option helps to prevent accidental data alteration. If this option is unchecked, Data Files are NOT write protected.
Auto delete incomplete Data Files (check box)	When this option is checked, **COMPASS** automatically deletes Data Files that do not include at least one complete test cycle. This avoids collecting partial Data Files for tests that were not completed. If this option is unchecked, a prompt for whether to delete the partial Data File or not appears whenever a test is aborted.
Data file delimiter (drop down list box)	This preference sets the data delimiter for the data in test Data Files (*.dat). The choices are comma, tab or semicolon. The semicolon delimiter is the default. The choice can be useful to assure compatibility when **COMPASS** Data Files will be exported to another program. The **COMPASS** internal data and report functions automatically detect and handle which delimiter was used in the Data File so the choice can be changed occasionally without affecting **COMPASS** operation. ⚠ *Be sure that the selected delimiter is not used as a character in any entry field or file delimiting will be incorrect.*
Root Data File directory (text entry field)	Defines the root directory to use when creating new DUT based sub-directories and copying Data Files. The selected directory can be on a network or on an internal hard drive. Any directory selection can be used provided there is enough room to store test Data Files and that the location is not write protected. Use the **<Browse>** button next to the entry field to select a new or existing directory using a directory browsing tool.

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FEATURE	DESCRIPTION
<Major sub-directory named by> (dropdown selection list)	**COMPASS** generates default file names for the Data Files (*.dat) it creates when a test is run. It also creates and uses default directories for the Data Files based on the DUT on which the test was run. This DUT dependent data directory is created as a subdirectory of the **<Root Data File directory>**. This feature automatically sorts Data Files in DUT dependent directories so that they can easily be located when desired. This option determines how major Data File directories will be named. The choices are DUT, serial number, identification, model or manufacturer. In addition, **<None>** can be selected. The directory name will include the full text of the selected DUT field unless the **<Use long Data File name…>** option is unchecked or the DUT field contains one of the following invalid characters as part of the field: **/**, ****, **?**, **:**, *****, **<**, **>**, **|**, or **"**. If so, the directory name will contain all text up to the first occurrence of the invalid character. The <Model> selection is recommended for this field even when only one type of DUT will be used by COMPASS.
<Minor sub-directory named by> (dropdown selection list)	This option is similar to the **<Major sub-directory named by>**. The difference is that the directory created by this selection is created as a subdirectory of the Major Sub-directory. The <Serial Number> of the DUT selection is recommended for this field.

14.9 [DATA IN FILE] TAB

The **[Tools]**, **[Options]**, **[Data In File]** tab is used to customize what data fields are actually logged in the test Data File. The selections do not affect the data displayed in the **Data Grid Run Screen**. Although a specific piece of data is not logged in a test Data File, it can still display in the **Data Grid Run Screen**. Refer to section 21.5.3, DATA Table, for a listing of the fields that can be logged to the data file. Only data actually logged to the Data File can be imported into the Test Data Database. Press the **[Default Settings]** button to automatically log the **COMPASS** default data fields.

When taking large amounts of data, it is desirable to reduce the file size. In such situations, data normally logged in short duration tests, may not be required. Reduce the file size by eliminating data fields using the features on this tab.

This feature actually re-arranges the columns of data in a test Data File. In most cases, this will cause problems with third party applications that were configured to read the Data File in a previous format. Only advanced users should use this feature to manipulate file data. The COMPASS Report Editor can read Data Files regardless of the format selected.

Data logged in the test Data File determines the data available in COMPASS Reports. Make sure that all desired data is collected by making the proper selections on the [Data In File] tab. When a test is complete, there is no way to retrieve data that was not logged to the Data File.

Multiple file fields can be selected in two ways: a) hold down the SHIFT key and use the UP and/or DOWN arrow keys to make multiple contiguous selections; b) hold down the CTRL key and us the mouse to make multiple non contiguous selections. Add or remove the selections by using the appropriate shift button.

Sort the <Fields to log> display by selecting an item then using the UP or DOWN arrow keys while holding the CTRL button.

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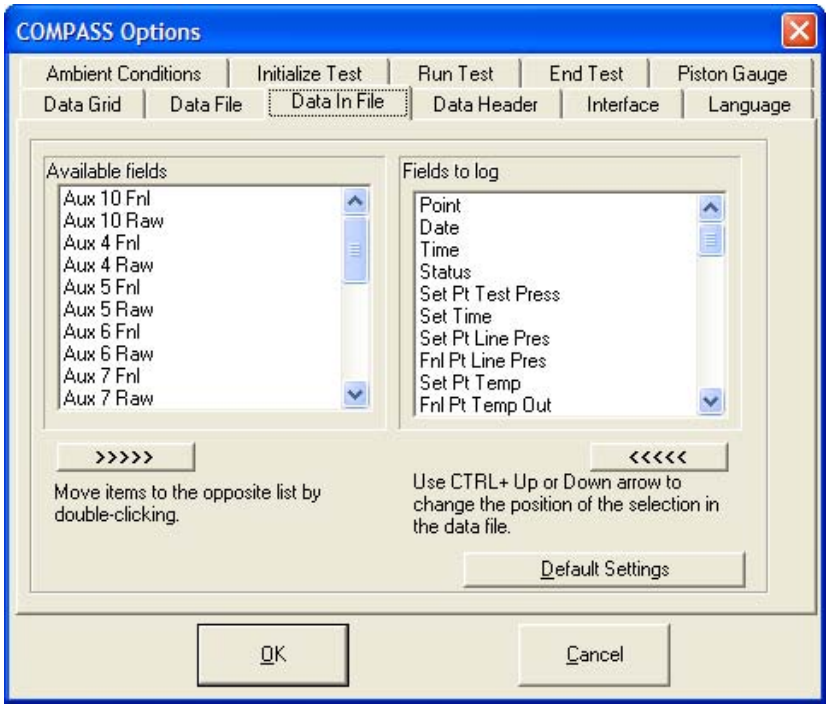

Figure 129. Options, **[Data In File]** Tab

14.10 [DATA HEADER] TAB

The **[Tools]**, **[Options]**, **[Data Header]** tab is used to customize the data logged in the header portion of a test Data File. Header data includes detailed information on the specific devices used to measure test data. Although header data is the basis of report information, not all header data is desired. Few **COMPASS** setups will require all header data. Check the header options relevant to your typical **COMPASS** setups.

Only header items actually logged to the Data File can be imported into the Test Data Database. This is evident by noting the number of devices listed in the **<Device Information>** section of the **COMPASS** Data Viewer (see 21.2, COMPASS Data Viewer).

⚠ *This feature actually modifies data logged in the Header portion of the test Data File. In most cases, this will cause problems with third party applications that were configured to read the Data File in a previous format. This feature should not be included as part of routine COMPASS use. Header data not logged in the Data File is not available in COMPASS Reports.*

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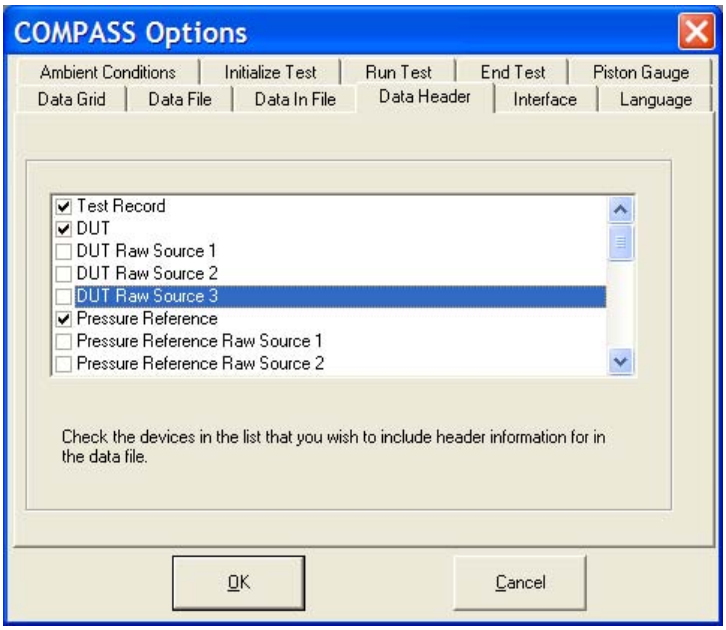

Figure 130. Options, **[Data Header]** Tab

14.11 [INTERFACE] TAB

The **[Tools]**, **[Options]**, **[Interface]** tab is used to set up the IEEE-488 card(s) that the computer running **COMPASS** can use for IEEE-488 communications and to define how RS232 ports are detected. The panel allows a Capital Equipment Corporation (CEC) or National Devices' IEEE-488 card to be selected and the card address to be specified.

The **<IEEE-488 Card>** pull down provides the choice of **<National Devices>** and **<CEC Capitol Equipment Corp>**. Clicking on the **<IEEE-488 Card Address>** field causes an address entry pop-up to be displayed. Only one address per card type is supported. This field represents the address of the IEEE-488 card itself and not any specific device. Refer to the card manufacturer documentation to determine how to change the address in the card when necessary.

The default selections within COMPASS are designed to operate with the default Windows set up of the supported IEEE-488 cards. Unless the host PC has multiple IEEE-488 cards or is specially configured, a properly installed IEEE-488 card with a default setup will work with COMPASS.

COMPASS automatically detects the RS232 ports on a host PC. However, some third party extended RS232 port cards may not be properly detected. As a result, the expected RS232 port will not be available in the RS232 setup. If this is the case uncheck the **<Only support detected RS232 ports>** option.

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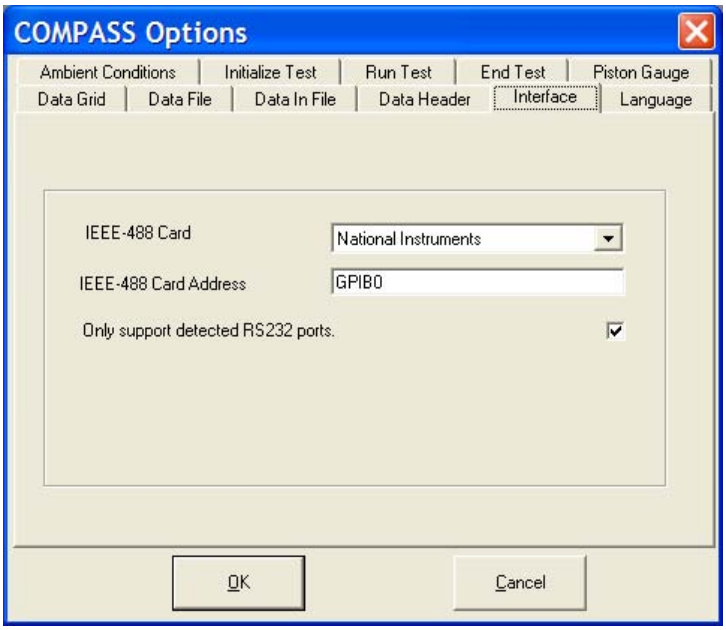

Figure 131. <COMPASS Options> [Interface] Tab

14.12 [LANGUAGE] TAB

The **[Tools]**, **[Options]**, **[Language]** tab is used to select and edit languages options in **COMPASS**. This release of **COMPASS** supports English only.

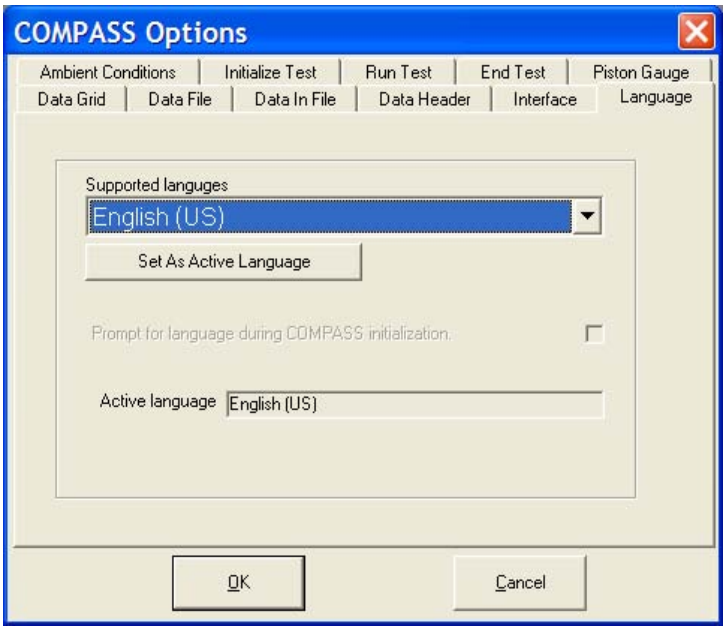

Figure 132. Options, **[Language]** Tab

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15. [TOOLS], [REMOTE COMMUNICATIONS]

The **<Direct Remote Communication>** form is accessible by using the shortcut icon in the **COMPASS for Pressure** program group or by using the **[Tools]**, **[Remote Communications]** menu choice in **COMPASS.** This tool provides a simple means of sending individual command strings to remote devices and receiving and displaying the response. This tool can be used for discreet remote device communication and communications testing. Use this tool to familiarize yourself with the device's communications, for troubleshooting communications problems and determining the appropriate commands to send prior to entering command information into of the Remote Command Editor (see 4.4, Remote Command Editor). If a command issued to a device does not give the desired results, refer to the device documentation for information on how to troubleshoot the problem. Try cycling power on the device and also try a command more than one time before concluding the command is in error.

See section 25, Remote Interfacing, for details on using the remote interfaces supported by COMPASS.

DHI device COM2 options are not supported by the Direct Remote Communication form. To test this functionality, manually set the device COM2 port to the RS232 settings of the device connected to the COM2 port. Then send commands with the COM2 prefix required by the product. In most cases, the prefix "#" will work. Refer to the Operation and Maintenance manual of the specific product for details on the pass through support.

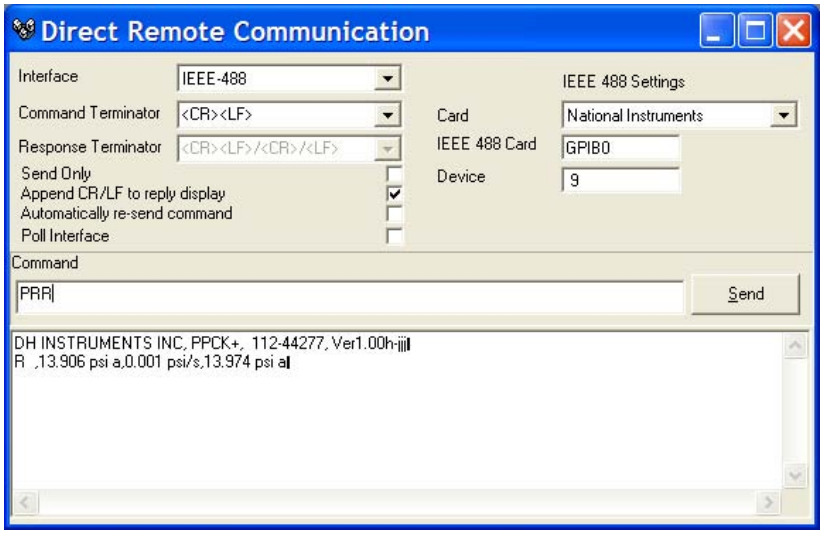

Figure 133. <Direct Remote Communication>

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Select an **<Interface>** and enter the necessary interface settings. Enter the command to be sent in the command field. Clicking **[Send]** or pressing the **[Enter]** key, causes the command to be sent using the current interface setup Results and return strings are displayed in the white portion of the form on the bottom of the display. These return strings are logged as read and unmodified by **COMPASS**. The communications time-out is fixed at 10 seconds. A time-out is indicated by displaying **<INTERFACE ERROR>**. If the command does not have a response or the target communications device does not normally respond to commands, click the **<Send Only>** check box or **COMPASS** will expect a response and time-out if none is received. Commands sent are automatically added to the drop down **<Command>** list; the list is cleared each time **COMPASS** is restarted.

Some RS232 devices automatically output data without requiring a command response pair. To test these interfaces, check the **<Poll Interface>** option. When active, this feature causes **COMPASS** to poll the selected RS232 port and automatically log any response. After a command has been issued, the selection can be toggled without any other required actions.

A mechanism is provided to send specific data bytes to a device. Enter the text "**BYTE:=**" followed by a series a data bytes (0 – 255) separated by spaces. The numeric values are converted to a sequence of characters and sent to the remote device. Make sure that decimal values are entered and not hex (255 not FF). For example, enter the command "BYTE:= 2 27" to send the characters 2 and 27 (Hex 02, 1B). Most devices that require specific byte data in this way do not use command or response terminators.

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16. [TOOLS], [PISTON GAUGE CALCULATOR]

16.1 OVERVIEW

The **Piston Gauge Calculator** is accessed using **[Tools]**, **[Piston Gauge Calculator]**. The features on this form allow any **COMPASS** supported Piston Gauge Platform, Piston-Cylinder, Mass Set, and Mass Bell to be selected and used to determine pressure based on mass load and other Piston Gauge Conditions. The Piston Gauge Calculator calculates mass to load to obtain a pressure or pressure resulting from a mass load. This is a quick and easy way to verify pressure calculations within **COMPASS** and to determine the pressure of a Piston Gauge without running a test or using a spreadsheet. All calculations used by this tool are detailed in section 29.8, Piston Gauge Pressure Calculations.

In addition to manual calculations, the Piston Gauge Calculator is used when running tests to display and calculate pressure for Piston Gauge test devices. During tests, this tool acts as a run screen to provide most of the same features that are available when not running a test (see 5.5.5, Piston Gauge device Output Run Screen). The limitations are imposed to prevent corruption of a Test Initialization Setup.

By default, the last used Piston Gauge and corresponding metrological elements are selected each time this tool is selected. To begin, always select a **<Piston Gauge Platform>**. The Piston Gauge Platform **Editor** provides features to associate metrological elements to a specific Piston Gauge Platform and determines the Piston Gauge type (Piston Gauge or Deadweight Tester). Only elements supported by the selected Piston Gauge Platform display in the lists at the top of **<Piston Gauge Calculator>**. Select the desired elements from the list and specify the **<Medium>** and **<Measurement Mode>**. The Piston Gauge Pressure is calculated based on these selections, the mass load and Piston Gauge conditions found at the bottom of the display beginning with **<Ambient Pressure>**.

Enter all relevant Piston Gauge conditions at the bottom of the display. **COMPASS** does not impose a limit on the values entered. Careful attention should be used to insure that the values entered are correct and in the proper units of measure.

To change the unit of measure for any field, click the label associated with the field to get a popup display of supported units for the selected field. Always enter values according to the unit displayed.

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Figure 134. Unit Selector

To use automated entry of ambient conditions when support devices are available, run a Manual Test and do not select a DUT (unless desired). Pressure can be calculated in the same manner as when this tool is accessed by using the [Tools],[Options] menu choice. However, the Piston Gauge platform setup information is disabled.

Click the label associated with the Piston Gauge Platform, Piston-Cylinder, Mass Set, Trim Mass Set, Mass Bell or Medium fields to display the current selection in it's corresponding editor. This allows quick un-editable access to all fields of the selected element. Right-Click the field to display the selected element in it's corresponding editor.

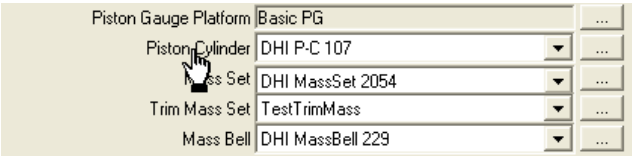

Figure 135. Display Piston Gauge Calculator Setup

Options in COMPASS are available to alter how the list of Mass Set masses display. See section 14.6, [Piston Gauge] Tab, for details on these features.

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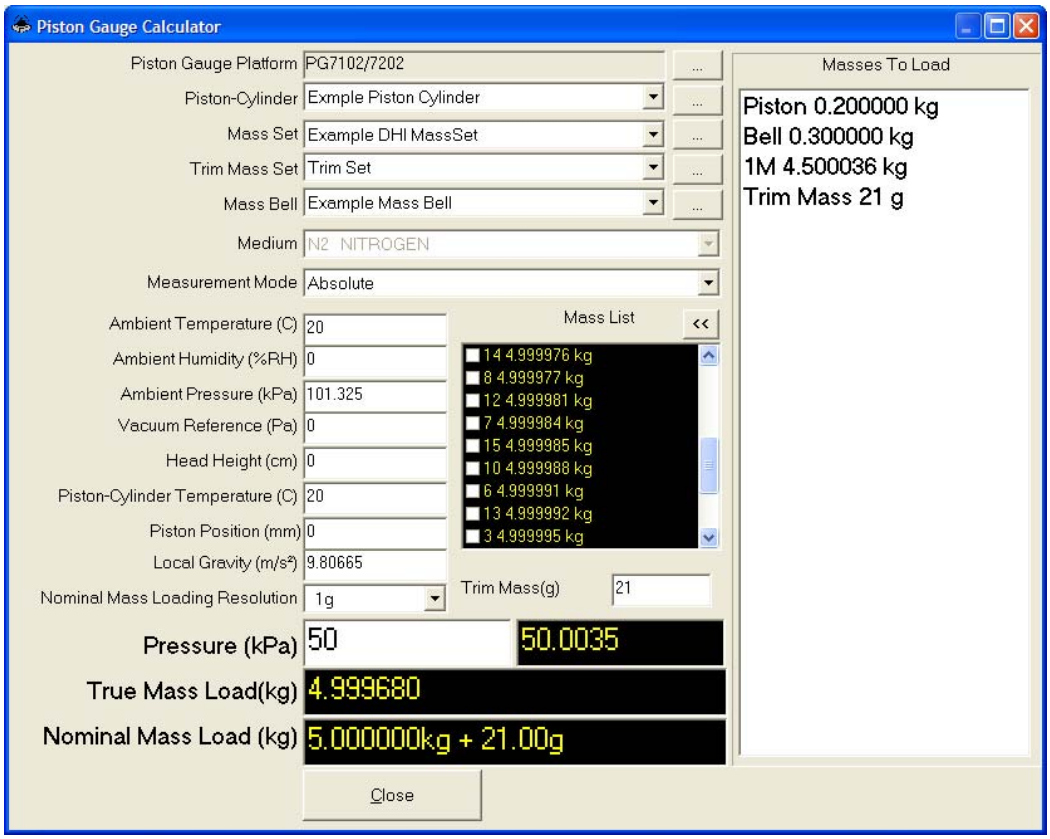

Figure 136. Piston Gauge Calculator

Table 62. Piston Gauge Calculator Fields

FEATURE	DESCRIPTION
Piston Gauge Platform (required selection)	Press the button next to this field to get a list of Piston Gauge Platforms that have been set up for use by **COMPASS**. Use the **Piston Gauge Platform Editor** to define new Piston Gauge Platforms as needed. Piston Gauge Platforms specify which Piston-Cylinders, Mass Sets and Mass Bells can be used with a specific platform.
Piston-Cylinder (required drop down list)	Select any Piston-Cylinder that can be used with the selected Piston Gauge Platform. To use any Piston-Cylinders supported by the Piston Gauge Platform Type, press the button next to this field to make a selection. The mass or pressure corresponding to the Piston-Cylinders displays in the **<Mass List>**. Use the **Piston-Cylinder Editor** to create and edit Piston-Cylinders.
Mass Set (required drop down list)	Select Mass Sets that can be used with the selected Piston Gauge Platform. To use any Mass Set supported by the Piston Gauge Platform Type, press the button next to this field to make a selection. The mass or corresponding pressure for each mass in the mass set display in the **<Mass List>.** Use the **Mass Set Editor** To create and edit Mass Sets.
Trim Mass Set (conditional drop down list)	Select Trim Mass Sets that can be used with the selected Piston Gauge Platform. To use any Trim Mass Set supported by the Piston Gauge Platform Type, press the button next to this field to make a selection. The total mass provided by the Trim Mass Set display in the **<Trim>** entry in the **<Mass List>**. The actual trim mass to use for calculations is A Trim Mass Set is not available when using a Deadweight Tester Type Piston Gauge Platform. This field is disabled in these cases. Use the **Mass Set Editor** To create and edit Trim Mass Sets.

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FEATURE	DESCRIPTION
Mass Bell (conditional drop down list)	Select Mass Bells that can be used with the selected Piston Gauge Platform. To use any Mass Bell in the **COMPASS** database, press the button next to this field to make a selection. The mass of the Mass Bell displays in the **<Mass List>**. A Mass Bell is not available when using Deadweight Tester Type Piston Gauge Platform since the Deadweight Tester Type Mass Bell is included in the Mass Set. This field is disabled in these cases. Use the **Mass Bell Editor** to create and edit Mass Bells.
Medium (required drop down list selection)	Select the pressure medium to use for pressure head corrections. The Piston Gauge Platform definition may limit the available media. If this is the case, the required medium is selected and this field is disabled. Use the **Pressure Media Editor** to create and edit pressure media.
Measurement Mode (required drop down list selection)	Select the supported pressure measurement mode from the list. Final output pressure is calculated differently for each measurement mode selected.
Ambient Pressure (conditional numeric entry)	Atmospheric pressure as entered by the user or read from a configured device when running a test. This value is not required in Absolute Measurement Mode and/or when using a Deadweight Tester Type platform.
Ambient Temperature (conditional numeric entry)	Ambient temperature as entered by the user or read from a configured support device when running a test. This value is not required in Absolute Measurement Mode.
Ambient Humidity (conditional numeric entry)	Atmospheric humidity as entered by the user or read from a configured support device when running a test. This value is not required in Absolute Measurement Mode.
Vacuum Reference (conditional numeric entry)	Residual pressure under the bell jar in Absolute Measurement Mode. The value is entered by the user or read from a configured support device when running a test. This value is not required in Absolute Measurement Mode only.
Head Height (conditional numeric entry)	The height difference between the reference level of the Piston Gauge and the location in which you wish to define pressure. Typically, this is the difference between the reference level of the Piston Gauge and a DUT. If the DUT is above the PG reference level, the value is positive. If the DUT is below the PG reference level, the value is negative.
Piston-Cylinder Temperature (conditional numeric entry)	Measured temperature of the Piston-Cylinder. The value is used to calculate the effective area of the piston-cylinder at the operating temperature using thermal expansivity. The value is entered by the user or read from a configured support device when running a test. This value is not required when using a Deadweight Tester Type Piston Gauge.
Local Gravity (required numeric entry)	Value of acceleration due to gravity at the sight of use. The value is entered by the operator. Typically, this is the gravity at the testing facility. However, any value can be entered to calculate the pressure that would be defined at different gravities.
Pressure Display Resolution (conditional drop down list)	Resolution to use when displaying the calculated pressure. Make a selection from the drop down list.
Mass Loading Resolution (conditional drop down list)	Determines the minimum mass value to be handled to set a pressure or mass target. With higher resolution, smaller masses are loaded and final pressure or mass value is closer to the nominal target. Masses that exceed the selected resolution are not selected by **COMPASS**. See section 16.3, Mass Loading Protocol for details on the mass loading algorithm.

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FEATURE	DESCRIPTION
Mass List (conditional check box list)	Select masses from the list to define a pressure in **Mass Selection Mode**. Only select masses that are (were) physically loaded onto the Piston-Cylinder. All elements that can be included in the mass load display in this list, including: Piston, Mass Bell and each individual mass in the selected Mass Set. Use **COMPASS** options to alter how the individual masses are displayed (see 14.6, [Piston Gauge] Tab). View the masses selected by **COMPASS** to achieve a mass or pressure target in **Mass Entry** and **Pressure Entry Modes**. Press the **<<** or **>>** buttons at the top of the Mass List to display the **Masses to Load** panel. This panel includes only masses specifically required to achieve the current target pressure. This prevents the need to scroll down the mass list to m make sure that all required masses have been loaded.
Trim Mass (conditional numeric entry)	Entry field in mass selection mode and mass entry mode for the value in grams of trim masses loaded. Most piston gauges include a set of trim masses (masses <100g) whose true values are equal to nominal values. These masses are used in addition to the main masses to set very specific mass loads. The value in this field is added to the sum of all the masses to arrive at the total mass load on the piston display in the **<True Mass Load>** field. In pressure entry mode, the **<Mass Loading Resolution>** feature can be used to limit the mass loading resolution and avoid the use of trim masses without affecting measurement uncertainty. Generally, mass loading resolution of 0.1 kg or more does not require use of trim masses. Trim Mass Sets are not used with Deadweight Tester Type Piston Gauges.
Pressure (conditional numeric entry)	The calculated pressure defined by the PG based on all selections and conditions in the units of measure to the left of the field. Double click the **<Pressure>** label to change the pressure unit of measure. Entering a value in this field puts the editor into **Pressure Entry Mode**. In this mode, there are two **<Pressure>** fields, one has a white background and the other has a black background. Use the white background field to enter a target pressure. When a pressure is entered, **COMPASS** calculates and displays the masses to load to achieve a pressure as close to the target pressure as possible, considering the **<Mass Loading Resolution>** and the masses available to achieve the target mass load. The black background field is the actual pressure defined when the piston is floating considering all selections and conditions.
True Mass Load (conditional numeric entry)	This field is not present when the active piston gauge platform is a Deadweight Tester type. When in pressure entry, nominal mass entry or mass selection mode, displays the true mass value loaded on the piston based on the selected masses in the **<Mass List>** and the trim mass value. This field can also be used to enter true mass loads. When entries are made, the field turns white. When a true mass value is entered, the corresponding pressure is calculated. The mass list and nominal mass are not used. Entering a value in this field puts the editor into **Mass Entry Mode**. In this state, there are two **<Mass Load>** fields one has a white background and the other has a black background. Use the white background field to enter a mass target. **COMPASS** selects masses to load the actual mass as close to the target value entered as possible. The **<Mass Loading Resolution>** and **Mass Set** ultimately determine how close to the target the final value will be. In most cases, the exact target will not be achieved. The actual final output mass load always displays with a black background.
Nominal Mass Load (conditional numeric entry)	Entering a value in this field puts the editor into **Mass Entry Mode**. In this state, there are two **<Mass Load>** fields one has a white background and the other has a black background. Use the white background field to enter a mass target. **COMPASS** selects masses to load the actual mass as close to the target value entered as possible. The **<Mass Loading Resolution>** and **Mass Set** ultimately determine how close to the target the final value will be. In most cases, the exact target will not be achieved. The actual final output mass load always displays with a black background.

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16.2 CALCULATION MODES

There are 4 different pressure calculation modes. Each determines pressure based on the setup information in the **Piston Gauge Calculator** display. The calculation mode is set automatically by making a selection or an entry in the **<Mass List>**, **<Pressure>**, **<Nominal Mass Load>** or **<Mass Load>** fields. The four modes are:

- **Mass Selection Mode** – Manually select masses from the **<Mass List>** and enter a value in the **<Trim Mass>** field and **COMPASS** calculates the resulting pressure. Trim Masses are available with Piston Gauge Type Piston Gauges Platforms only.
- **Pressure Entry Mode** - Enter a target pressure value in the **<Pressure>** field. **COMPASS** selects the mass set masses required to set the target pressure as close as possible using the current mass loading resolution setting. Decrease the mass loading resolution to set pressure closer to the target value.
- **Nominal Mass Entry Mode** - Enter a mass value within 0.1 kg in the **<Nominal Mass Load>** and trim mass in the **<Trim Mass>** field if trim mass is being used. **COMPASS** calculates the resulting true mass load and the resulting pressure. The masses loaded following normal **COMPASS** mass loading protocol are checked in **<Mass List>** table.
- **True Mass Entry Mode** - Enter the total true mass load in the **<True Mass Load>** field. **COMPASS** calculates the resulting pressure. Trim masses and the individual mass selector are not used.

16.3 MASS LOADING PROTOCOL

The mass loading protocol is used to allow **COMPASS** to consistently select masses to load to achieve a desired target pressure. The required masses to load are selected in the **<Mass List>** and displayed on the **<Masses to Load>** panel. The corresponding nominal mass and true mass totals display in the **<Nominal Mass>** and **<True Mass>** fields (see 16, [Tools], [Piston Gauge Calculator]). Only **Pressure Entry Mode** and **Nominal Mass Entry Mode** use this mass loading protocol (see 16.2, Calculation Modes). The **Mass Selection Mode** allows the operator to directly select the individual masses to use to solve the pressure equation. Masses are not selected in **True Mass Entry Mode**.

In principal, the method resembles the protocol in the PG7000 (refer to the PG7000 Operation and Maintenance Manual, Mass Loading Protocol). First the required nominal mass load is determined based on the target pressure or mass value entered. The true mass load is determined when nominal mass values are not specified in the mass set (see 11.4.3, [Mass Set] Tab). Starting with the piston (and bell if necessary) the masses are selected from largest to smallest respecting the current mass loading resolution until the target mass value is achieved. If a makeup mass is selected in the mass set, it is selected for loading immediately following the mass bell if the current mass load requires it. Masses that do not meet the mass loading resolution limit are not used. As a result, the requested pressure may differ significantly from the actual pressure available based on the mass set mass increment.

Always load the masses that are selected in the <Mass List> or displayed on the <Masses to Load> panel when prompted. Failure to load the correct masses will cause a disagreement between the pressure displayed on the Piston Gauge Calculator and the actual piston gauge pressure.

Deadweight Tester Piston Gauge Platforms use the same protocol. However, the calculations are simplified because the mass values are already specified in a pressure unit.

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17. [TOOLS], [PG7000 SETUP EXTRACTOR]

17.1 OVERVIEW

The **PG7000 Setup Extractor** is used to read Piston-Cylinder, Mass Set and Mass Bell setup information from **DHI** PG7000s and write the results to the **COMPASS** database. The information in the database can also be written to the PG7000. Use this tool to load PG7000 metrological information into the database to allow **COMPASS** to solve the pressure equation instead of the PG (see **DHI** PG7000).

To use this tool, the first step is to select the remote interface to use to communicate with the PG7000. Select the **<Interface>** type and enter the corresponding settings. Press the **[Load PG Information]** button to read all metrological information from the PG. Select the **<Element Type>** to update the available Piston Gauge Settings on the left of the form. On the right side of the form, the corresponding elements in the **COMPASS** database display. To write information to the database, check the items on the left and press the **<Right>** arrow. To write elements to the PG7000, check the items on the right and press the **<Left>** arrow. Select a different **<Element Type>** and repeat the process.

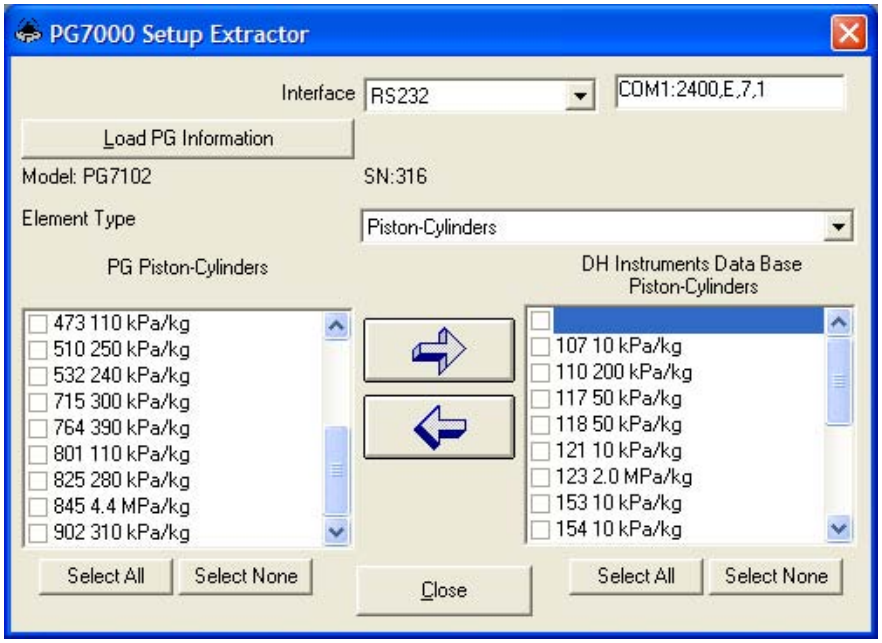

Figure 137. PG7000 Setup Extractor

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NOTES

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18. [TOOLS], [COMPASS MACRO EDITOR]

18.1 OVERVIEW

COMPASS for Pressure Macros open the door to a high level of program customization. Macros are available to read instruments, calculate instrument outputs, modify test operation and manipulate data in the Data File for custom reporting. Macros are defined and maintained by the **COMPASS** Macro Editor (see **Figure 138**).

Macros are an advanced COMPASS feature. Some programming knowledge is required to successfully create and use a macro. Before using a macro, make sure that the desired operation is not a standard COMPASS feature. In most cases, a macro is not necessary.

COMPASS does not halt test operation in the event of a macro error. Make sure that a macro is functioning properly before running an unattended test.

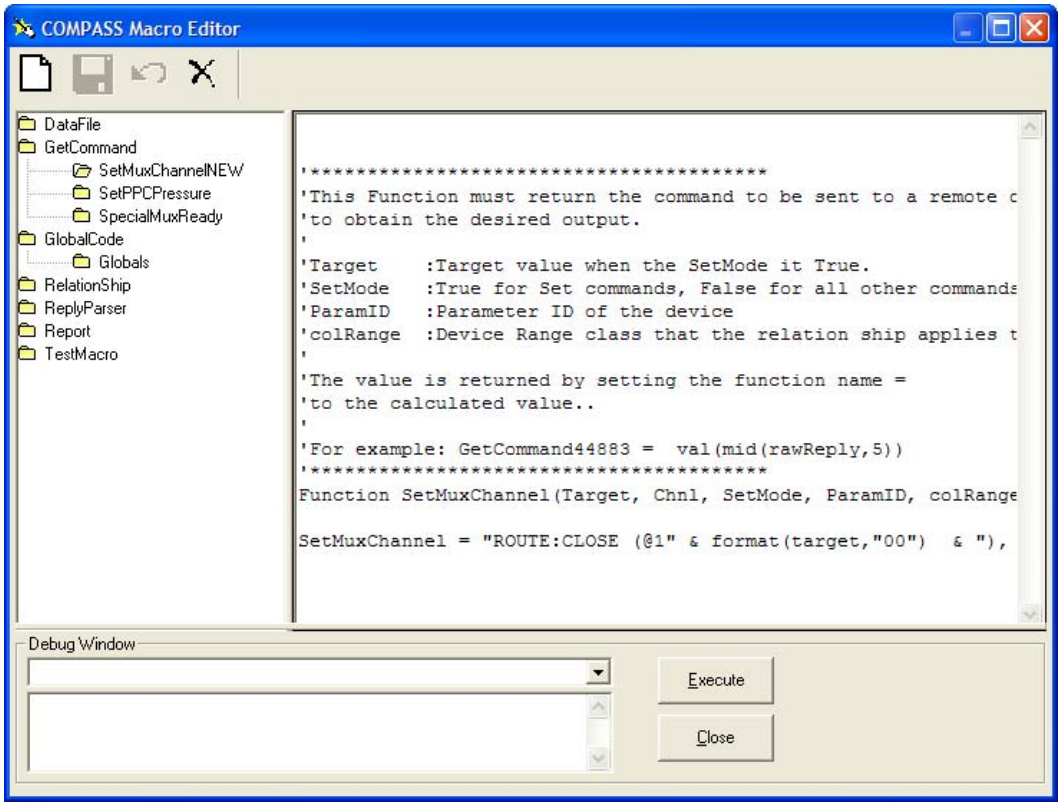

Figure 138. COMPASS Macro Editor

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Macros are VB Script functions that are called by **COMPASS** at specific times during test execution. One macro can represent many individual functions. Each macro type uses different arguments. Using these arguments, the code defined in the VB Script function can directly execute to complete an operation and return the results to **COMPASS**. In addition, the macro can call ActiveX controls, DLLs, and other programs to complete a task. The code in the macro can change the state of object variables in **COMPASS** using the **COMPASS** object model.

Detailed information on VB Script is beyond the scope of this document. Visit http://msdn.microsoft.com/library/default.asp?url=/library/en-us/script56/html/vtoriVBScript.asp for a complete language reference. Realize that VB Script can call other programs that expose functions to the Windows environment. Therefore, any language that supports ActiveX technology can be used to develop the code used by the macro. The COMPASS macro would simply call this newly developed program.

18.2 VB SCRIPT

VB Script is the macro language of **COMPASS for Pressure**. This a common scripting language used in many applications. This section includes information related to common problems and benefits associated with VB Script. Although VB Script is very similar to Visual Basic, there are a few key differences:

1. **Variables cannot be declared with a specific data type. All variables are of the Variant data type. The type conversion functions (**cDec**,** cSng**,** cStr**,** cDbl**, ect) must be used to obtain a specific data type when required by a function.**
2. **VB Script is not fully compiled. Therefore most errors in the code are not detectable until the macro is used.**
3. **The** COMPASS **Macro Editor does not provide syntax highlighting and there are no pop-up menus available to view the properties, events and methods of objects within a macro.**

Fortunately, there are many similarities. Knowing Visual Basic dramatically simplifies the learning curve of VB Script and macro creation in **COMPASS**. Below is a list of language features that are common to both languages and frequently used in macro implementation in **COMPASS**.

1. For**,** Do**, and** While **loops are supported.**
2. **With blocks can be used to avoid using explicit variable qualification.**
3. **Program comments are indicated by a " ' " at the beginning of line.**
4. **Objects can be created and used by VB Script. Use the GetObject and CreateObject functions as needed. The objects returned by these functions can be stored within a COMPASS object or as global objects within a macro module so that the object is not destroyed when a particular script function goes out of scope.**
5. **Good programming practice is always recommended to simplify troubleshooting. Use a consistent variable naming convention and add comments to describe the intended function of code.**

A more detailed discussion of this language is beyond the scope of this manual. Visit the URL below for a complete language reference. Refer to the **COMPASS** Objects section for information on the objects that **COMPASS** makes available to the language (see 28.1, COMPASS Objects).

http://msdn.microsoft.com/library/default.asp?url=/library/en-us/script56/html/vtoriVBScript.asp

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18.3 USING THE MACRO EDITOR

The **COMPASS** Macro Editor can be accessed from many different areas of **COMPASS**. The **[Tools]**, **[COMPASS Macro Editor]** menu displays the editor as well as all list box options that provide a selection for a **COMPASS** macro. The editor never starts with a specific macro selected.

The left of the editor contains a list of the different macro types. Click on a macro type to expand the list to include existing macros of the selected type. When an individual macro title is selected, the corresponding script displays on the right side of the display. Syntax highlighting is not available in the **COMPASS** Macro Editor. All text will look the same.

Macros can be created and removed by using the toolbar functions on the top of the editor. The functions on this toolbar are consistent with all other editor toolbars in **COMPASS**. When the **[New]** toolbar function is pressed, a new macro function with a default name is created. The function arguments specific to the type of macro are included with the default function. At this point the editor will be in edit mode (see Figure 139). Change the name of the default function to a name specific to the function's use. Never use the same function name twice. The argument names can be changed as well. The order of the arguments however cannot be changed. **COMPASS** always sends arguments in the order specified by the macro type. If desired, arguments can be removed, but new arguments cannot be added.

Enter the code in the macro as required to complete the specific requirements of the macro function. Refer to the comments at the top of the function for details on the purpose of the function and a description of the arguments. Some knowledge of the **COMPASS** object model is required to manipulate **COMPASS** objects during test execution (see 28). In addition to the arguments of any macro function, there are global objects available for use.

Prior to saving a macro, enter unique text in the **<Title>** field that accurately represents the macros specific purpose. Macros are listed in **COMPASS** by the value entered. A well-titled macro is easy to select and use in **COMPASS**. Up to 50 characters can be used to label the macro. Press the **[Save]** toolbar function when all macro edits are complete. Any number of macros can be created for any given macro type.

To edit a macro, just begin typing and the editor will go into edit mode.

COMPASS imposes no restrictions on the names of macro functions. Always use descriptive names and never give the same function name or title to more than one macro. Macro functions are selected by <Title> not by function name. Function names must be unique to avoid conflicts with functions that have the same name.

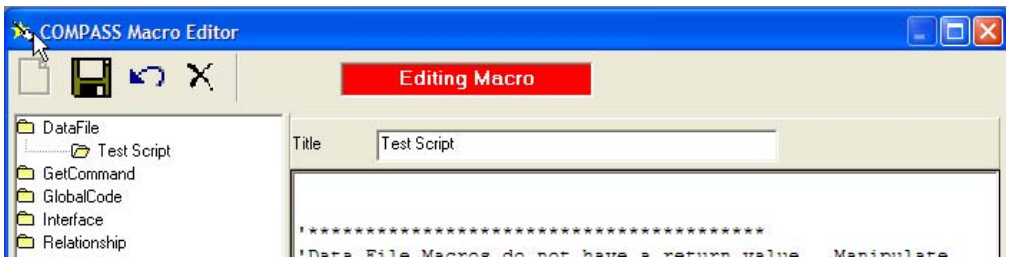

Figure 139. COMPASS Macro Editor in Edit Mode

The bottom of the **COMPASS** Macro Editor includes a debug window (see **Figure 140**). Perform simple command and function tests by entering code in the top line and pressing enter. Routines that return a value should always be proceeded with a "?". This includes VB Script intrinsic functions as well as

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functions defined in the macro. Routines that do not return a value should be entered directly in the top line without a prefix. Press **[Enter]** or **[Execute]** test the code. The field below the top line displays the output of the script entered or an error message.

Macro functions that include objects cannot be tested in the <Debug Window>. Functions that use objects within the macro code must be tested while running tests or when generating reports. Review section 18.4, Troubleshooting Macros, for the details on testing object based macros.

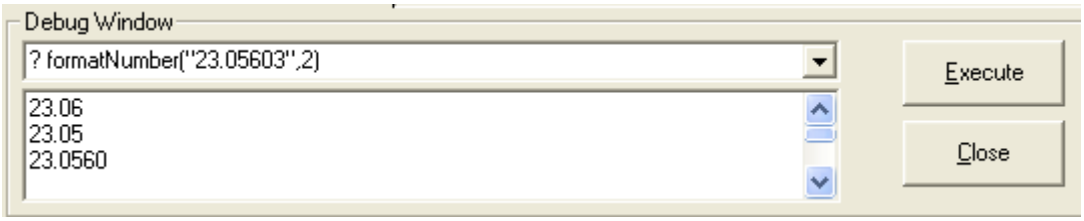

Figure 140. Macro Editor in Debug Window

18.4 TROUBLESHOOTING MACROS

COMPASS macros are not compiled. As a result, errors are not detected until the macro is actually used. A simple type-o can prevent a macro from functioning properly. Always use consistent variable naming and comment the macro to simplify the troubleshooting process.

Macros can be edited while a test is running. This is recommended for troubleshooting purposes only. Run a **Manual Test** or a **Test Definition** and determine if the desired macro operation is functioning properly. Display macro error messages by choosing the **[Tools]**,**[Run Test] <Display macro errors>** option. This may require viewing the Interface Spy window of an output, looking at the **Device Output** window of the instrument, or noting the operation sequence in a test. Always watch the **Status Bar** on the bottom of the display and note any error messages that display. Use the **[Tools]**,**[COMPASS Macro Editor]** menu choice to display the **COMPASS Macro Editor**. Locate the macro in question and make edits as needed to correct the macro. Save the macro and close the **COMPASS Macro Editor** and again check to see if the macro is operating properly. It may be necessary to comment out portions of the macro to find out at what point the macro generates an error or display information on the **COMPASS** status bar by using the **COMPASS** object, ***cCOMPASS.StatusDisplay***. Having the macro return a constant value is also useful when trying to find out the point at which the macro fails.

Macros can be tested within the Macro Editor provided that the macro code does not reference any **COMPASS** objects. These objects are available when running only. To get around this issue, comment out parts of the code that uses these objects. Enter a "?" followed by the function name and any function parameters in the **<Debug Window>** at the bottom of the editor.

Data File and Report Macros should be tested and verified in the **COMPASS** Report Editor using the same basic techniques mentioned above.

Before troubleshooting a macro, make sure that the macro is selected for the device in question or assigned to a report template.

The most common problem in a macro is a misspelled variable. Always double check spelling. The exact macro function name must be set to the return value of the function for COMPASS to properly process the macro.

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18.5 MACRO TYPES

There are 8 different types of **COMPASS** macros. Each macro has a specific purpose and is provided with unique parameter input. When a macro is selected, it is called by **COMPASS** during test execution to complete a specific operation. The macros are selected in specific **COMPASS** editors. **Table 63** summarizes the different types of **COMPASS** macros, how they are used and when they can be used. A typical device macro sequence is detailed in **Figure 141**. Understanding this sequence is important to understand how each macro interacts with the output of an instrument.

Table 63. COMPASS Macro Types Summary

MACRO TYPE	DESCRIPTION
Data File	**Data File Macros** are used to manipulate data stored in the test Data File. These macros are used in the report editor only. All existing **Data File Macros** are available for selection in the **<Macros>** section in the **<Available Data Fields>** list while editing a report template in the Report editor. Data Files macros are intended to create columns of test data based on data logged during the test. However, any data in the Data File can be manipulated.
GetCommand	These macros are used to create read and set commands for an instrument. The macros are selected only in the remote command editor. The **<Command>** drop down list contains macros defined in this section (see 4.4.4). A macro to obtain a read command is called only one time. A macro that provides a set command is called each time a new set command is necessary. This is because the new target most likely requires a new command. It is not always necessary to use a macro to create set commands. **COMPASS** provides a substitution method that works with most ASCII based remote commands. Refer to the **<Apply Set>** topic in 4.4.4.
Global	These macros are available to all other macros. There are no specific parameters or required return types for these macros. Common manipulation functions should be added to this section. **COMPASS** does not directly access this type of macro.
Interface	**Interface Macros** provide an alternate remote interface choice for devices. The **Interface Macro** is available on the **Read** and **Set** tabs of the device editors when the remote interface selection is **<Macro>**. At user defined intervals **COMPASS** will call the **Interface Macro** to read the output of a device. Macros defined on the **Set** tab are called each time a new target is requested with the device. **Interface Macros** allow users to continue using their existing data acquisition code while taking advantage of the benefits in **COMPASS**. They also allow **COMPASS** to indirectly support a number of remote interfaces.
Relationship	**Relationship Macros** are used to calculate a final output from raw output information. The raw output of an instrument can be manipulated any way desired (or required) to obtain a final output. Other **COMPASS** data is available for use in the manipulation. The macro should return the final output of the instrument in the specified final output unit. There is virtually no limit to the manipulation capabilities of this macro. For example, ambient pressure and temperature can be used to correct the output voltage of a transducer to obtain a final pressure for the transducer. The output of a transducer can be corrected with an adder and multiplier to obtain a fully compensated final output. This type of macro is selected using the **Read Relationship Editor**. Set relationships cannot use macros to obtain a raw set value. When a **Relationship Macro** is used, it is called each time a raw output is available for the selected instrument.

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MACRO TYPE	DESCRIPTION
Reply Parser	This type of macro is used to manipulate the raw remote response of an instrument into a numerical value that can be used by **COMPASS**. Realize that there are built-in manipulation functions that allow **COMPASS** to obtain a response from most ASCII output instruments. Refer to the **<Manipulate Response>** topic in 4.4.4. These macros are selected in the **Remote Command Editor** and called each time the instrument that uses the macro responds to a remote command. The macro must return a numeric value that represents the raw output of the device in the specified raw output unit.
Report	**Report Macros** are used by the report editor only. Select this macro when making a report template. The Data File information should be manipulated to obtain a single output used for reporting. For example, multiple test Data Files can be manipulated to determine repeatability or test uncertainty. The value returned by the macro is added to the report without further manipulation. Any unit conversion or numeric formatting must as must be handled within the macro.
Test	**Test Macros** are available for advanced tests only. There are many different ways to use a **Test Macro**: beginning of a test, end of test, at each point or when changing references or controllers. These macros are used only when executing a Test Definition. A **Test Macro** can be used in any way desired. It is up to the user to decide the intent of a **Test Macro**. **COMPASS** does not use the response of this macro. In general, a **Test Macro** should alter the normal sequence of a test. A few common **Test Macros** may do the following: control valves in a timed sequence, repeat test points if the error exceeds a certain limit, load calibration data from instruments in the test. A high level of understand of the **COMPASS** object model is required to properly execute a **Test Macro**. All objects are available for use within the macro.

The following sections detail each macro type and include an example of use. Realize the function names are user defined. Function names should resemble the use or output of the function. Always use comments to document the steps of a function.

Refer to section 28 for details on COMPASS objects when interpreting arguments to the macro functions.

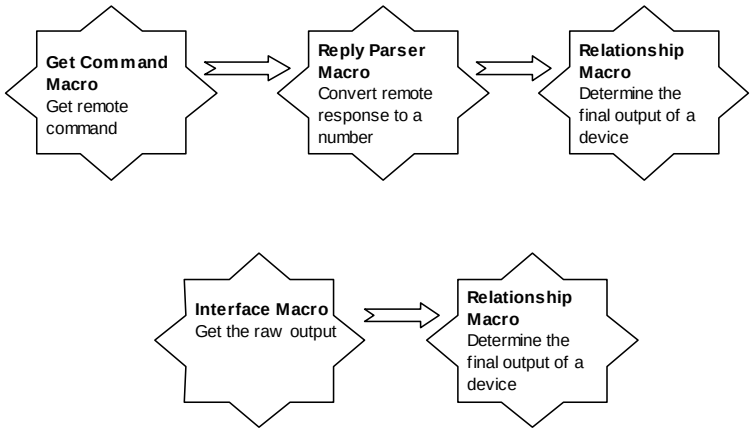

Figure 141. Device Output Macro Sequence

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18.5.1 DATA FILE MACROS

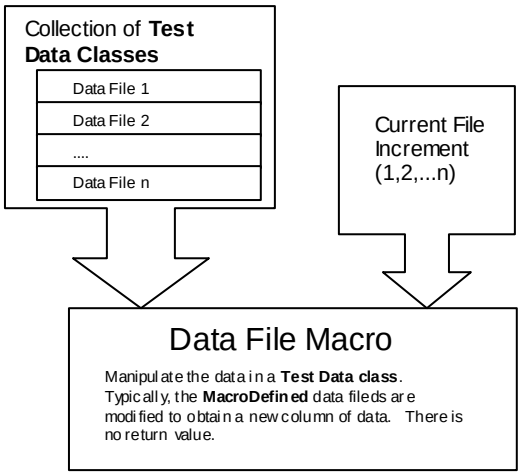
Collection of **Test Data Classes**
Data File 1
Data File 2
....
Data File n
Current File Increment (1,2,...n)
Data File Macro
Manipulate the data in a **Test Data class**. Typically, the **MacroDefined** data fileds are modified to obtain a new column of data. There is no return value.

Figure 142. Data File Macro Prototype

Purpose **Data File Macros** are used to manipulate data stored in the test Data File. These macros are used in the report editor only. Generally, the macro defined data in the Data File is updated to hold information determined by the macro (see 28.2). This information is available for reporting by creating a report template that includes the fields altered by the macro.

Syntax `Function DataFileMacro(colData, curFile)`

Arguments

- **colData** – A collection of all active **Test Data Classes**. A separate data class is used for each Data File in the report editor.
- **CurFile** – The collection index of the **Test Data Class** that is actively being reported.

Return Value The return value is not used by **COMPASS**.

Remarks The **COMPASSS Report Editor** calls any **Data File Macros** defined in a report template prior to generating a report with that template. When multiple Data Files are selected, the template macro is called multiple times. Each call to the macro will include the collection index of the Data File being reported (**curFile**). If the macro will manipulate data from multiple files in a single call, use an ***if*** statement to prevent the macro from executing redundantly. For example:

```
if curFile <> 1 then Exit Function
```


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Example This example determines the applied force on the internal mechanics of a DUT at each test pressure. The template should include a table that has the data field **MacroDefined1**. Add this field by editing a template and dragging the **MacroDefined1** field form the list of **<Available Data Fields>** into a table. The **Report Editor** will execute the macro and generate the report. The table that includes the **MacroDefined1** value will list the force of each pressure.

```
'*******************************************************
'Calculate the force applied to the DUT
'based on the DUT pressure.
'
'ColFiles   A collection of all active Data Files.
'CurFile    ID of the current Data File.
'
'*******************************************************
Function CalcForceData(colData, curFile)

With colData(curFile)
    'Determine the Area constant for the
    'DUT.  The DUT must be setup with the
    'Area constant as Calibration Coefficient 1 and the
    'diameter must be saved as Coefficient 2.

    AC = cdbl(.DUT.CalibrationCoefficient1)  'Convert string to Double
    D = cdbl(.DUT.CalibrationCoefficient2)

    A = D^2 * AC  'Conversion factor to lbs Force from psi

    'Create a column of data to hold the
    'new lbs Force Value and corresponding Error
    for c = 1 to .NumberOfPressureCyclePoints
        'Update the value for all pressure cycles

        for p = 1 to .NumPressurePoints
            T = A * .DataPointRef(1, 1, c, p).DUTPressure
            'Limit the value to 4 digits of resolution
           .DataPointRef(1, 1, c, p).MacroDefined1 = FormatNumber(T,4)
        next
    next

End With

End Function
```

18.5.2 GET COMMAND MACROS

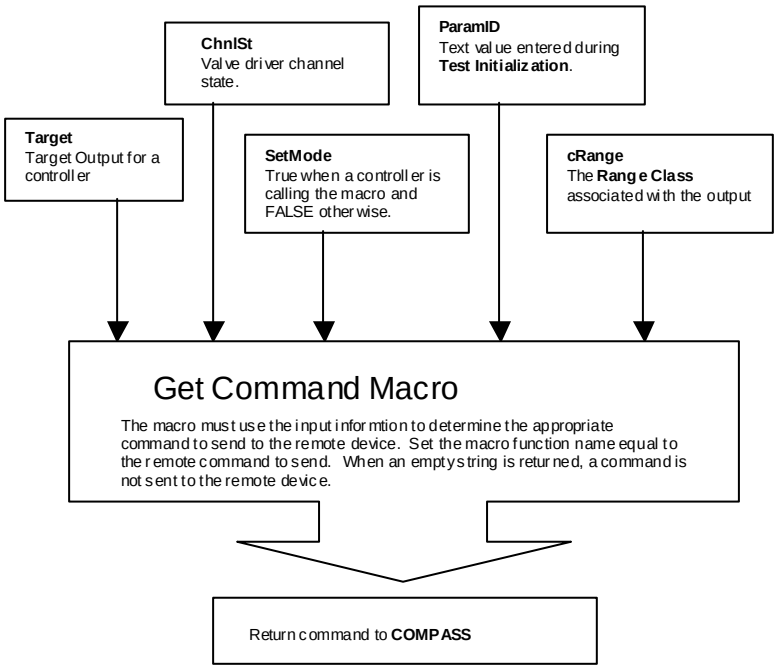
ChnlSt
Valve driver channel state.
ParamID
Text value entered during Test Initialization.
Target
Target Output for a controller
SetMode
True when a controller is calling the macro and FALSE otherwise.
cRange
The Range Class associated with the output
Get Command Macro
The macro must use the input information to determine the appropriate command to send to the remote device. Set the macro function name equal to the remote command to send. When an empty string is returned, a command is not sent to the remote device.
Return command to COMPASS

Figure 143. Get Command Macro Prototype

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Purpose **GetCommand Macros** are used to create remote commands for devices that cannot use a constant ASCII string entered directly in the **Remote Command Editor**. **COMPASS** calls these macros as needed to obtain read and set commands. The return value of the macro must be the remote command to send to the instrument using the instruments remote interface. If an empty string is returned **COMPASS** will not send the remote command.

Syntax `Function GetCommand(Target,ChnlSt,SetMode,ParamID,cRange)`

Arguments

- **Target** – The target output value when the **SetMode** parameter is TRUE. The target output is determined by a Test Definition or by manual control of a device. Read commands to not use this argument. The value is always 1- n when used with a multiplexer or valve driver object
- **chnlSt** – The activation state of a multiplexer or valve driver channel. The value is either TRUE or FALSE. This value is TRUE only when the device in requiring the macro is a Valve Driver Controller. It is false in all other cases.
- **SetMode** – TRUE for set commands and FALSE for read commands.
- **ParamID** – User defined identification value for a device. This value can be entered only during test initialization. It is used as a flag to handle similar devices differently. Particularly when devices require individual command addressing. This is frequently the case when instruments are connected using an interface chain.
- **cRange** – The **Range Class** of the instrument requesting the remote command.

Return A string representing the command to send to an instrument using the instruments remote interface settings. If an empty string is returned “”, **COMPASS** does not send a command.

Remarks Commands that respond are polled by **COMPASS**. Macros created for these commands are called only one time. Commands used for control, are issued discretely. When a macro command is used, each new target output automatically calls the selected macro. The macro code should use the target information and other arguments to create the desired remote command.

Although the arguments to this macro allow the set and read command request to be distinguish from each other, it is recommended that separate macros be created for setting and reading with different instruments. The arguments are provided for the case in which one instrument can set and read an output. In this case, a single macro should be created to handle the different command requests. Having all of the code in one location will simplify edits and troubleshooting.

Example This example returns a command used to read an instrument based on it’s **ParamID** value. This command would be polled by the remote interface of **COMPASS**. The user must set the **Parameter ID** field to the appropriate value during test initialization for this macro to function properly. It is not required to use this method. If only DUTs are using an address based command chain, the position of the DUT in the DUT object collection can be used to determine the address ID value of a command.

```
‘**************************************
‘Return pressure output in psi.
‘
‘Target    :Target value when the SetMode it True (Valve Driver Chnl).
‘ChnlSt    :True/False to activate or de-active a valve driver.
‘SetMode   :True for Set commands, False for all other commands.
‘ParamID   :Parameter ID of the device
‘cRange  :Device Range Class that the relation ship applies to.
‘
‘The value is returned by setting the function name =
‘to the calculated value..
‘
‘For example: GetCommandMacro =  val(mid(rawReply,5))
‘**************************************
Function GetCommandMacro(Target, ChnlSt, SetMode, ParamID, cRange)

if ParamID > 9 then
    cmd = “*” & ParamID & “00P3”
else
    cmd = “*0” & ParamID & “00P3”
end if

GetCommandMacro = cmd

End Function
```


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This example creates a command to change the multiplexer channel. The **Target** value is always 1 – n when used with a multiplexer or valve driver object. In this particular example, channels on 2 banks on the multiplexer must be closed. If one channel were required and more than 9 channels would not be used, a macro would not be necessary.

```
'**************************************
'Close the multiplexer channel for the HP3488
'multiplexer.
'
'Target    :Target value when the SetMode is True (Valve Driver Chnl).
'ChnlSt    :True/False to activate or de-active a valve driver.
'SetMode   :True for Set commands, False for all other commands.
'ParamID   :Parameter ID of the device
'cRange    :Device Range Class that the relation ship applies to.
'
'**************************************
Function SetMux2Channel(Target, ChnlSt, SetMode, ParamID, cRange)

if Target < 9 then
    cmd = "ROUTE:CLOSE (@10" & target  & "), (@20" & target & ")"
else
    cmd = "ROUTE:CLOSE (@1" & target  & "), (@2" & target & ")"
end if

SetMux3Channel = cmd

End Function
```

18.5.3 GLOBAL MACROS

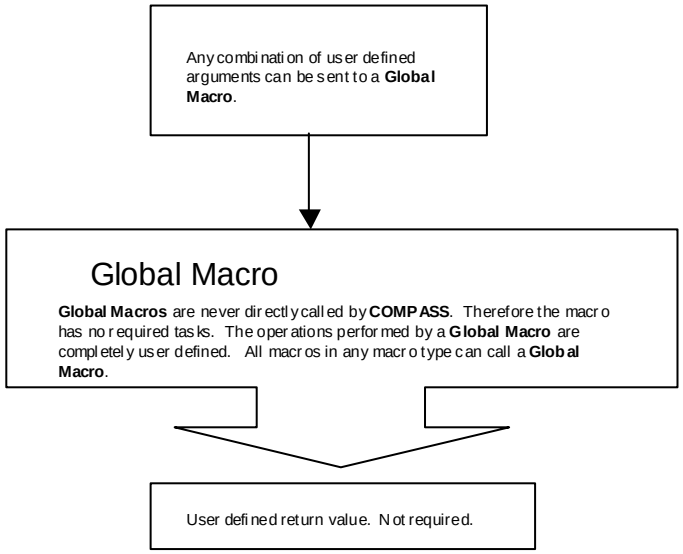
Any combination of user defined arguments can be sent to a Global Macro.
Global Macro
Global Macros are never directly called by COMPASS. Therefore the macro has no required tasks. The operations performed by a Global Macro are completely user defined. All macros in any macro type can call a Global Macro.
User defined return value. Not required.

Figure 144. Global Macro Prototype

Purpose **Global Macros** are never directly accessed by **COMPASS**. Therefore, there are no limitations to the purpose or use of a **Global Macro** function.

Syntax User defined.

Arguments User defined.

Return Value User defined.

Remarks Use **Global Macros** to support standard macros. A well written **Global Macro** can be used by many macros. If the code added to the **Global Macro** will be used by only one macro, add the code in a separate function at the end of the macro that will use it. Having all relevant code in the same edit space simplifies troubleshooting.

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Example This example macro reads a file when given a fully qualified file name and path. The contents of the file are returned in one string. This script creates an instance of the FileSystemObject. This object is very useful when working with files.

```
''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''
'Read a text file and return the contents as a string
'
''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''
Public Function ReadAllTextFile(fName)
Dim fso, f

Set fso = CreateObject("Scripting.FileSystemObject")
Set f = fso.OpenTextFile(fName, 1)

ReadAllTextFile = f.ReadAll   'Read the entire file into that variable

End Function
```

18.5.4 INTERFACE MACROS

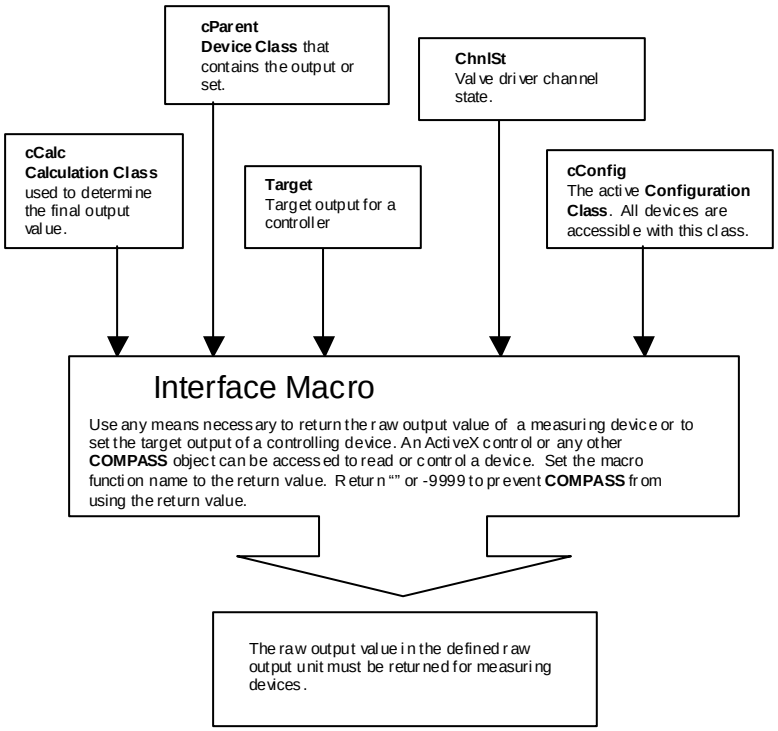
cParent
Device Class that contains the output or set.
ChnlSt
Valve driver channel state.
cCalc
Calculation Class used to determine the final output value.
Target
Target output for a controller
cConfig
The active Configuration Class. All devices are accessible with this class.
Interface Macro
Use any means necessary to return the raw output value of a measuring device or to set the target output of a controlling device. An ActiveX control or any other COMPASS object can be accessed to read or control a device. Set the macro function name to the return value. Return "" or -9999 to prevent COMPASS from using the return value.
The raw output value in the defined raw output unit must be returned for measuring devices.

Figure 145. Interface Macro Prototype

Purpose An **Interface Macro** must read the output of an instrument using code directly written in the macro or by calling an OLE object that communicates with the device. This type of macro is used most frequently when the desired remote interface is not available within **COMPASS**.

Syntax `Function ioMacro(cCalc,cParent,fTarget1,bChnlSt, cConfig)`

Arguments

- **cCalc** – The **Calculation Class** of the device.
- **cParent** – The parent **Device Class**.
- **fTarget1** – The double precision Target output to use when controlling tan output. When used for a device specified as a multiplexer or valve driver this value is an integer that represents the channel to manipulate.
- **chnlSt** – TRUE or FALSE to activate or de-activate a valve driver channel. Only used when the device is initialized as a valve driver controller.
- **cConfig** – **Configuration Class** that holds all active **Calculation Classes** within **COMPASS**.

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Return Value

The return value must be the raw output of the instrument in the raw output unit specified in the **Output Relationship Editor** (4.3.6.2).

Return an empty string "" or –9999 to prevent **COMPASS** from using the response. **COMPASS** will not abort or display an error message. The return value is simply ignored.

Remarks

Interface Macros specified for Read commands are called at the approximate interval selected on the **[Communications]** tab in any of the device editors. **COMPASS** checks the interval time every 250ms. As a result, the time interval value has an effective resolution of 250ms.

In most cases, an **Interface Macro** should call an OLE object to read the output of an instrument. This allows existing data acquisition code to be used by **COMPASS**.

Take advantage of the object and data space available within the **COMPASS** defined objects. These fields exist when the macro is not being used. As a result, an OLE object can be created and stored in a **COMPASS** object, and used each time the macro is called. This is a logical scenario assuming one instance of the OLE object is required to read one device. If one OLE object can read multiple devices, store the object in the cls**COMPASS COMPASS** defined object. When the OLE object is not created by the macro code, there is no reason to store the object within a **COMPASS** object. This is assuming that there is not a situation in which the OLE object can be destroyed by an outside program. This is typically the case when an existing program will run in parallel with **COMPASS**. **COMPASS** automatically removes the reference to any objects

COMPASS imposes no limit on the parameters or function names for an OLE object used within a macro. It is recommended that any required arguments to the OLE object be the output of data members of the cParent Class. In particular the ParamID property. This method allows a **COMPASS** user to alter the behavior of the macro by changing a setup value during test initialization.

Example

This example creates an instance of the clsExample data acquisition object to read the output of a device. The object is stored in the **Calculation Class** to prevent the object from being destroyed when the macro code looses scope. A flag is set in the **Calculation Class** when the clsExample is loaded. This allows the macro to create the object one time

```
'**************************************
'Read the output of the device using the
'clsExample data acquisition object.  Store
'the object in the Calculation Class.
'
'cCalc     :The Calculation Class of the device.
'cParent   :The parent Device Class.
'fTarget1  :Target output for controller.
'bChnlSt   :True/False to activate or de-active a valve driver.
'cConfig   :Configuration Class that holds all active Calculation Classes.
'
'The value is returned by setting the function name =
'to the calculated value..
'
'**************************************
Function GetActiveXPressure (cCalc, cParent, fTarget1, bChnlSt, cConfig)

with cCalc
    If .ParamData(1) = 0 then
       'Set an instance of the object into the obj1 property

        Set .Obj1 = GetObject("", "DaqObj.clsExample")
        If .Obj1.LoadFile(.RangeMain.GetParent.SN) = False Then Exit Function

        'Set the flag to prevent a new class from loading
        cCalc.SetParamData 1, 1
    End If


   GetActiveXPressure =  .Obj1.GetPressure(cParent.SN )

end with

End Function
```

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18.5.5 RELATIONSHIP MACROS

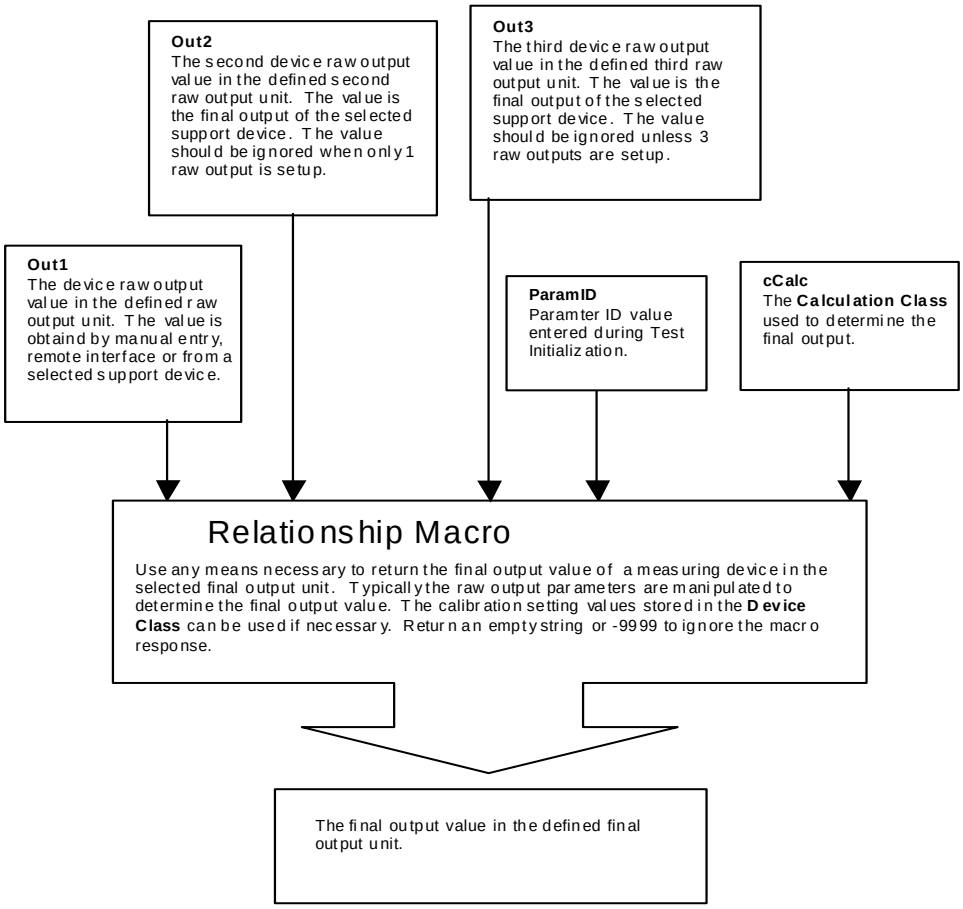
Out2
The second device raw output value in the defined second raw output unit. The value is the final output of the selected support device. The value should be ignored when only 1 raw output is setup.
Out3
The third device raw output value in the defined third raw output unit. The value is the final output of the selected support device. The value should be ignored unless 3 raw outputs are setup.
Out1
The device raw output value in the defined raw output unit. The value is obtaind by manual entry, remote interface or from a selected support device.
ParamID
Paramter ID value entered during Test Initialization.
cCalc
The Calculation Class used to determine the final output.
Relationship Macro
Use any means necessary to return the final output value of a measuring device in the selected final output unit. Typically the raw output parameters are manipulated to determine the final output value. The calibration setting values stored in the Device Class can be used if necessary. Return an empty string or -9999 to ignore the macro response.
The final output value in the defined final output unit.

Figure 146. Relationship Macro Prototype

Purpose A **Relationship Macro** is used to manipulate the raw output of an instrument to obtain a final output value. Use this macro when the standard conversion functions in **COMPASS** are not adequate. The parameters passed to the function and/or data in other **COMPASS** objects should be used to obtain the device's final output.

Syntax `Function Relationship(Out1,Out2,Out3,ParamID,cRange)`

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Arguments

- **Out1** – The first raw output of the device. The raw output may be the final output of another instrument or the output remotely acquired directly from the instrument. The **Output Relationship Editor** determines how the value is acquired. If a separate instrument is used, the Test Initialization process allows the user to select what instrument to use. The argument is a double precision number in the raw output unit specified in the output setup.
- **Out2** – The second raw output of a device. This value is used only when 2 or more raw outputs are defined in the **Output Relationship Editor** for the device output. The value is always the double precision final output of another instrument in the raw output unit specified for the second raw output in the **Output Relationship Editor**.
- **Out3** – The third raw output of a device. This value is used only when 3 raw outputs are defined in the **Output Relationship Editor** for the device output. The value is always the double precision final output of another instrument in the raw output unit specified for the third raw output in the **Output Relationship Editor**.
- **ParamID** – User defined identification value for a device. This value can be entered only during test initialization. It is used as a flag to handle similar devices differently. Particularly when devices require individual command addressing. This is frequently the case when instruments are connected using an interface chain.
- **cCalc** – The **Calculation Class** of the instrument requiring manipulation. Use the properties of the **Calculation Class**.to access the necessary **Range** and **Device Classes**.

Return Value

The return value must be the final output of the instrument in the final output unit specified in the **Output Relationship Editor** (4.3.6.2).

Return –9999 to prevent **COMPASS** from using the response. **COMPASS** will not abort or display an error message. The return value is simply ignored.

Remarks

Almost any level of mathematical manipulation can be performed on the output(s) of an instrument. Anytime an output is defined with more than 1 raw output, a **Relationship Macro** is required.

Use this macro in conjunction with the CalInfo properties of the **COMPASS Device Class** to apply a calibration to an output. For example, when an adder and multiplier are specified for CalInfo1 and CalInfo2, respectively, a **Relationship Macro** can multiply the raw output by the multiplier and add the adder to yield a calibrated final output value. The calibration coefficient properties can be entered manually when a device is defined, or populated by a macro.

Example

This macro returns a gauge pressure from an absolute pressure. In this example, the output was setup such that the first raw output is the RS232 output of an absolute pressure transducer. The second raw output is ambient pressure. **COMPASS** passes these values to the macro in arguments Out1 and Out2 respectively.

```
'**************************************
'Return the Gauge pressure
'
'Out1     :By default, this is the raw formatted, output of a
'          device.  In other cases, it is final output of a
'          test configured device in the configured output unit.
'Out2     :Final output of a test configured device in the
'          configured output unit.
'Out3     :Final output of a test configured device in the
'          configured output unit.
'ParamID  :Parameter ID of the device .
'cCalc    :Device Calculation Class that the relation ship applies to.

'The value is returned by setting the function name =
'to the calculated value..
'
'For example: Relationship51602 = 1 / Out1^.5
'**************************************
Function CalcGaugePressure(Out1, Out2, Out3, ParamID, cCalc)

CalcGaugePressure = Out1 - Out2

End Function
```

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Example This macro applies a third order fit to the raw output of a device. This allows **COMPASS** to display a real time compensated pressure. In this example, the calibration coefficient properties were set by the user when the device was created. Calibration coefficients can be entered on the **[Calibration]** tab of any of the device editors (4.3.4).

```
'**************************************
'Return the fully compensated pressure
'
'Out1     :By default, this is the raw formatted, output of a
'          device.  In other cases, it is final output of a
'          test configured device in the configured output unit.
'Out2     :Final output of a test configured device in the
'          configured output unit.
'Out3     :Final output of a test configured device in the
'          configured output unit.
'ParamID  :Parameter ID of the device .
'cCalc    :Device Calculation Class that the relation ship applies to.
'
'The value is returned by setting the function name =
'to the calculated value..
'
'For example: Relationship51602 = 1 / Out1^.5
'**************************************
Function CalcAdjustPressure(Out1, Out2, Out3, ParamID, cCalc)

With cCalc.RangeMain.GetParent
    A = .Calinfo1
    B = .Calinfo2
    C = .Calinfo3
    D = .Calinfo4
End With

P = A *Out1^3 + B*Out1^2 + C*Out1 + D

CalcAdjustPressure = P

End Function
```

18.5.6 REPLY PARSER MACROS

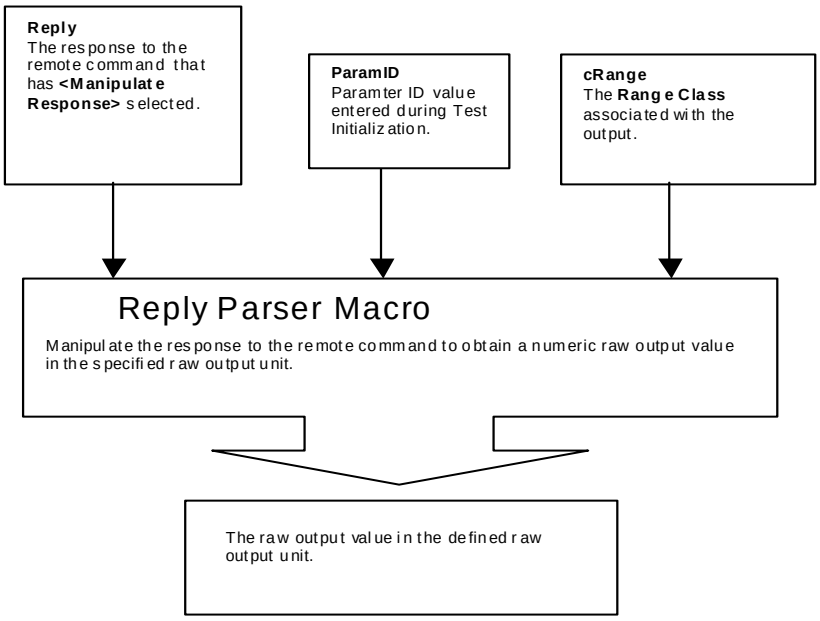
Reply
The response to the remote command that has <Manipulate Response> selected.
ParamID
Paramter ID value entered during Test Initialization.
cRange
The Range Class associated with the output.
Reply Parser Macro
Manipulate the response to the remote command to obtain a numeric raw output value in the specified raw output unit.
The raw output value in the defined raw output unit.

Figure 147. Reply Parser Macro Prototype

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Purpose This type of macro is used to manipulate the raw remote response of an instrument into a numerical value that can be used by **COMPASS**. The response should be the instruments raw output in the selected raw output unit. Whenever possible, use the built in parsing functions instead of a macro.

Syntax `Function ParseOutput(Reply, ParamID, cRange)`

Arguments

- **Reply** – The unmanipulated response from the remote interface of the device. The command that has the **<Process Response>** value checked is used to generate the response.
- **ParamID** – User defined identification value for a device. This value can be entered only during test initialization. It is used as a flag to handle similar devices differently. Particularly when devices require individual command addressing. This is frequently the case when instruments are connected using an interface chain.
- **cRange** – The **Range Class** of the instrument requiring manipulation.

Return Value The return value must be the raw output of the instrument in the raw output unit specified in the **Output Relationship Editor** (see 4.3.6.2).

Return an empty string, "", when a value cannot be determined. **COMPASS** will not abort or display an error message. The return value is simply ignored.

Remarks The remote response of instruments varies dramatically with manufacturer and industry. As a result, a standard scheme to obtain a numerical output from a remote command is not possible. However, in many cases the standard **COMPASS** manipulation routines can be used to obtain a valid numeric output from a remote command (see 4.3.8).

A thorough understanding of the instruments remote interface is needed to determine the requirements of a **Reply Parser Macro**. Sometimes the response processing may involve extensive string manipulation, and other times it may require mathematical manipulation. A **Reply Parser Macro** can also be used to determine if a response is valid. **COMPASS** does not perform product specific error handling on the remote output of non **DHI** products. A **Reply Parser Macro** can be used to verify that the output is valid to prevent taking erroneous data. Use the **Interface Spy** window of the device output to verify that the macro is functioning properly (5.5.4.1).

In some cases there is a fine line between using a **Relationship Macro** and a **Reply Parser Macro**. Generally, a **Reply Parser Macro** is not necessary when the output of an instrument can be manipulated into a real number by using the text delimiting mechanism in **COMPASS**. When a **Reply Parser Macro** is used, it is OK to manipulate the response beyond the raw output value and into the final output value. If this is the case, make sure that the selected relationship of the output is **<Same>**. This prevents another layer of manipulation applied to the response of the macro.

Ready commands must respond with TRUE or FALSE to indicate ready and not ready. **COMPASS** considers 0 to be FALSE and any other value to be TRUE. Set commands do not require response manipulation since the response of a set command is ignored by **COMPASS**.

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Example This macro returns a temperature value based on the hexadecimal output string of an instrument. The function must assemble the number from different parts of the return string by using string and numeric manipulation functions.

```
'**************************************
'This Function must return the fully formatted response
'of a device.  The output is used as the Raw output
'in the relationship determination of the Final Output.
'
'Reply     :Raw unmanipulated response of a device.
'ParamID   :Parameter ID of the device
'cRange    :Device Range Class that the relationship applies to.
'
'The value is returned by setting the function name =
'to the calculated value.
'**************************************
Function ParseOutput(Reply, ParamID, cRange)

sNum1 = mid(reply,3,2)   'Value left of decimal
sNum2 = mid(reply,5,2)   'Value Right of decimal

sNum = cStr(cdbl("&H"& sNum1))  'convert hex to a numeric string
sNum = sNum & "." & cStr(cdbl("&H"& sNum2)) 'Add decimal portion of number

'convert the string to a double and return
ParseOutput = cdbl(sNum)

End Function
```

Example This macro returns TRUE when the output of a controller is ready and FALSE otherwise. In this example, the controller's remote response is a status bit field. The 5th bit is set only when the controller has achieved the target output.

```
'**************************************
'This Function must return the fully formatted response
'of a device.  The output is used as the Raw output
'in the relationship determination of the Final Output.
'
'Reply     :Raw unmanipulated response of a device.
'ParamID   :Parameter ID of the device
'cRange    :Device Range Class that the relationship applies to.
'
'The value is returned by setting the function name =
'to the calculated value..
'
'**************************************
Function OutputReady(Reply, ParamID, cRange)

if Reply and 2 ^ 5 then
    OutputReady = TRUE
Else
    OutputReady = FALSE
End if

End Function
```


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18.5.7 REPORT MACROS

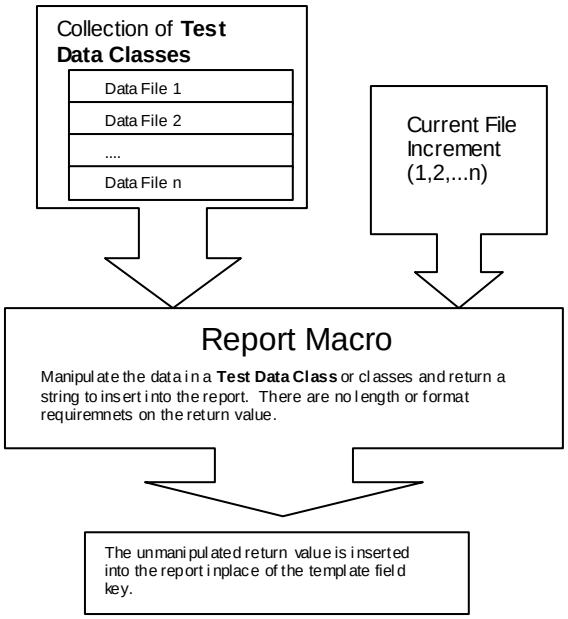
Collection of **Test Data Classes**
Data File 1
Data File 2
....
Data File n
Current File Increment (1,2,...n)
Report Macro
Manipulate the data in a **Test Data Class** or classes and return a string to insert into the report. There are no length or format requiremnets on the return value.
The unmanipulated return value is inserted into the report inplace of the template field key.

Figure 148. Report Macro Prototype

Purpose **Report Macros** return a single string to use in a report. Information stored in the test Data File should be manipulated by accessing the properties in the **Test Data Class**.

Syntax `Function ReportMacro(colData, curFile)`

Arguments

- **colData** – A collection of all active **Test Data Classes**. A separate data class is used for each Data File in the report editor.
- **curFile** – The collection index of the **Test Data Class** that is actively being reported.

Return Value Return a string value to include in a report. An empty string is treated no differently that a populated string.

Remarks **Report Macros** are frequently used to perform high level calculations with Data File data. Before creating this type of macro, make sure that the desired output is not already in the list of **<Available Data Fields>** when creating a report template.

To use a **Report Macro**, create or edit a report template and insert the desired macro in the template. During report generation, the macro is called and the return value is added to the report in place of the field added in the template.

Do not use a **Report Macro** to manipulate the macro defined data in the Data File in the same manner as a **Data File Macro**. A **Report Macro** is called during report generation. There is no guarantee that data manipulated by the macro will be reported correctly. **Data File Macros** are called before a report is created, thus guaranteeing that modified data is available for reporting.

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Example This macro returns the text PASS, FAIL or VERIFY based on the maximum error in the Data File.

```
'**************************************
'Report Macros are intended to return a single value. Manipulate
'the data in the data collection as desired.
'
'colFIles    A collection of all active Data Files.
'curFile     ID of the current Data File.
'
'**************************************
Function GetPassFail(colFiles, curFile)

With colData(curFile).SummaryCalculationCollection(1)

   If abs(.MaxFSError) > .007 then
       rtv = "FAIL"

   elseif abs(.MaxFSError) > .005 then
       rtv = "VERIFY"

   else
       rtv = "PASS"

   end if

End With

GetPassFail = rtv

End Function
```

Example This macro outputs the first and second order DUT transfer function and the corresponding correlation coefficients. The global macro function **polyfit** is used to determine the first and second order coefficients and corresponding correlation value.

```
'******************************************************
'
'ColFiles   A collection of all active Data Files.
'CurFile    ID of the current Data File.
'
'******************************************************
Function FitNewData(colData, curFile)
dim  coefs(4,7)

With colData(curFile)
   'Create an array to store the data
   'Poly fit is 0 based so 1 less than the actual total is needed
    redim RefP(.NumberofPressurePoints-1)
    redim DUTOut(.NumberofPressurePoints-1)

    'Create the arrays of DUT V and Ref Pressure
    for p = 1 to .NumberofPressurePoints
       RefP(p - 1)  = .DataPointRef(1, 1, 1, cint(p)).RefPressure
       DUTOUT(p - 1)  = .DataPointRef(1, 1, 1, cint(p)).DUTRawOutput1
    next

end With


'Fit the DUT output vs the reference output.
'Only determine the 1st and 2nd order coefficients
i = Poly_Fit(DUTOUT, RefP, coefs, 2^0 or 2^1)

'Return the results as a string
temp1  = "First Order: " &  formatNumber(coefs(0,1),5) & "V + " &_
FormatNumber(coefs(0,0),5)   'First Order

temp1 = temp1 & vbcrlf &  "Correlation:" & formatNumber(coefs(0,6),7)

temp2  = "Second Order: " &  formatNumber(coefs(1,2),5) & "V" & chr(178) & " +_
" & formatNumber(coefs(1,1),5) & "V + " & formatNumber(coefs(1,0),5)

temp2 =temp2 & vbcrlf &  "Correlation:" & formatNumber(coefs(1,6),7)


'Return them both separted by a new line
FitNewData = temp1 & vbcrlf & temp2


End Function
```


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18.5.8 TEST MACROS

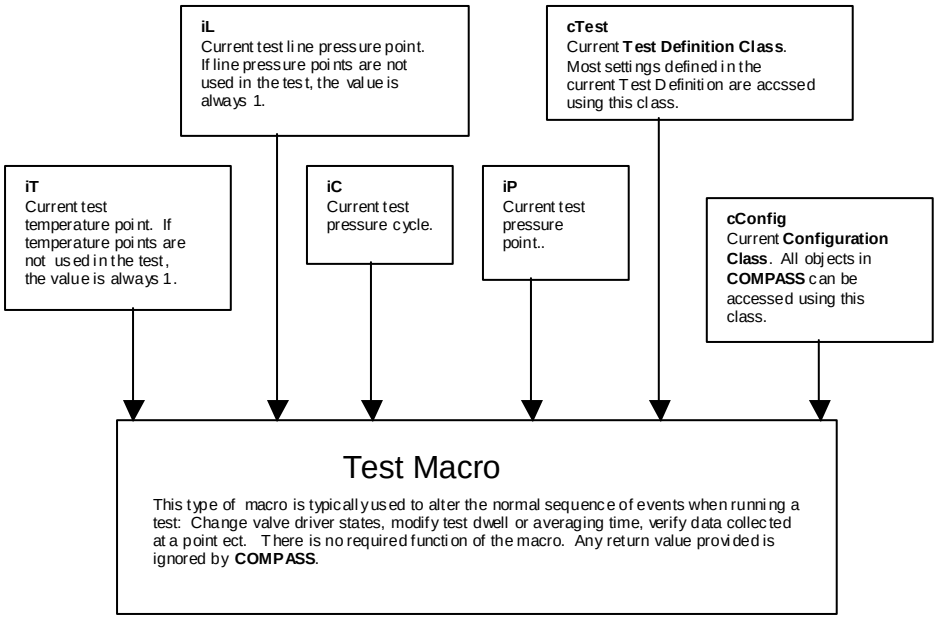
iL
Current test line pressure point. If line pressure points are not used in the test, the value is always 1.
cTest
Current Test Definition Class. Most settings defined in the current Test Definition are accssed using this class.
iT
Current test temperature point. If temperature points are not used in the test, the value is always 1.
iC
Current test pressure cycle.
iP
Current test pressure point..
cConfig
Current Configuration Class. All objects in COMPASS can be accessed using this class.
Test Macro
This type of macro is typically used to alter the normal sequence of events when running a test: Change valve driver states, modify test dwell or averaging time, verify data collected at a point ect. There is no required function of the macro. Any return value provided is ignored by COMPASS.

Figure 149. Test Macro Prototype

Purpose A **Test Macro** is used to alter the normal sequence of events when running a Test Definition. All devices setup during Test Initialization are available for use within the macro.

Syntax `Function TestMacro(iT, iL, iC, iP, cTest, cConfig)`

Arguments

- **iT** – The current test temperature point in the Test Definition. When the test does not use a sequence of temperature points, the value is always 1.
- **iL** – The current test line pressure point in the Test Definition. When the test does not use a sequence of line pressure points, the value is always 1.
- **iC** – The current test pressure cycle in the Test Definition. When the test does specify multiple pressure cycles, the value is always 1.
- **iP** – The current test pressure point.
- **cTest** – The active **Test Definition Class**.
- **cConfig** – **Configuration Class** that holds all active **Calculation Classes** within **COMPASS**.

Return Value Any return value provided is not used by **COMPASS**.

Remarks **Test Macros** are called prior to setting a test temperature, line pressure or pressure point and before changing the active test reference or controller. The macro must be selected in Test Definition of an advanced test (see 8.1).

⚠ There is no time-out imposed on Test Macros. If the macro code creates an infinite loop, the active Test Definition will hang until the user aborts the test.

Review the properties and methods of the **Configuration Class** and the **COMPASS Class** prior to creating a **Test Macro**. Use the **Configuration Class** properties to control various test instruments. This class allows the macro to change the test pressure, send commands directly to any configured test instrument, and view the output of any test instrument. The **COMPASS Class** should be used to repeat test points and pause system operation as required by a macro.

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Example This example macro is used to change the pneumatic connections of a test prior to changing test controllers. In many occasions, changing a test controller or reference requires isolating one device from the test pressure and exposing another device to the test pressure. To safely make this transition the test pressure must be vented. This macro vents the test pressure and delays 60s using a **Global Macro** function. The valve driver channels are then set isolate and expose the old and new pressure controllers.

```
'**************************************
'Test Macro do not have a return value.  Manipulate
'the test or device collection as desired.
'iT  The current temperature point in the test
'iL  The current line pressure point in the test.
'iC  The current pressure cycle in the test.
'IP  The current pressure point in the test.
'cTest   The test class .
'cConfig  Configuration Class that holds all active devices.
'
'**************************************
Function TestVent(iT, iL, iC, iP, cTest, cConfig)

'Vent before using the active Reference
'pressure controller
b = cConfig.SetPrs(cConfig.ActiveRefSetP).ioSetOutput(0, 1, 1)

Delay 60  'Wait for the pressure to stabilize

With cConfig.ValveDriver1
   'Activate Driver 2 to isolate first controller
    b = .ioSetOutput(2,1,0)

    'Activate Driver 3 and disable driver 1
    'to expose new controller
    b = .ioSetOutput(3,1,0)
    b = .ioSetOutput(1,0,0)

End With

End Function
```

18.6 THREADING MODEL

COMPASS macros and the **COMPASS** main program share a common program thread of execution. When a macro is actively running, there are parts of **COMPASS** that are not running. Particularly code that updates remote interfaces and corresponding object outputs. Therefore, as a general rule, limit the scope of a macro to handle a specific task and exit. When **COMPASS** is running on a PC that meets the minimum requirement, there is no noticeable impact on program performance unless an indefinite loop is used within the macro.

When a macro is required to handle or use the change in output of one or more devices or if the macro will execute a loop for an extended amount of time, use the **cCOMPASS.TimeDelay** method (see 28.9.2). This method returns the shared program thread back to the main program. This allows the output of all instruments to update in their various objects and on the corresponding run screens. In most cases, a delay time of 0.5 seconds is all that is required.

Because of the shared program thread, a macro that "locks up" will effectively lock up **COMPASS**. To avoid this potential problem systematically check the state of the **cCOMPASS.SystemAbort** property if the macro will execute a loop (see 28.9.1). When this value is TRUE, **COMPASS** has aborted so any active macro should also abort.

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18.7 VARIABLE AND FUNCTION SCOPE

As with any other programming language, each function and variable used within a macro has a specific scope. Knowing the proper function and variable scope can greatly simplify macro development. In many cases, a well developed function can be used many times from different macros.

A macro can represent one or many functions. The only requirement is that the first function represent the macro called by **COMPASS**. Any number of support functions can be created following this main function. This grouping of functions will reduce troubleshooting time in the event of an error. All functions of the same macro type can be called by any other function of the same macro type. For example, any function created within an **Interface Macro** can call any other function created within an **Interface Macro**. The one exception is for **Global Macros**. All functions in all modules can access **Global Macro** functions. There are many useful **Global Macro** functions provided in the default **COMPASS** database.

Any variable created within a macro function is a **Local Variable**. No other macro function can access the data in a **Local Variable.** Variables declared before the first function in a macro are available in all functions created in the current macro and any other macro of the same macro type. These variables are **Module Variables**. **Module Variables** are declared using the "DIM" statement, for example: "Dim iCounter". A **Module Variable** created in a **Global Macro** is a **Global Variable**. All macros regardless of their macro type can access **Global Variables**.

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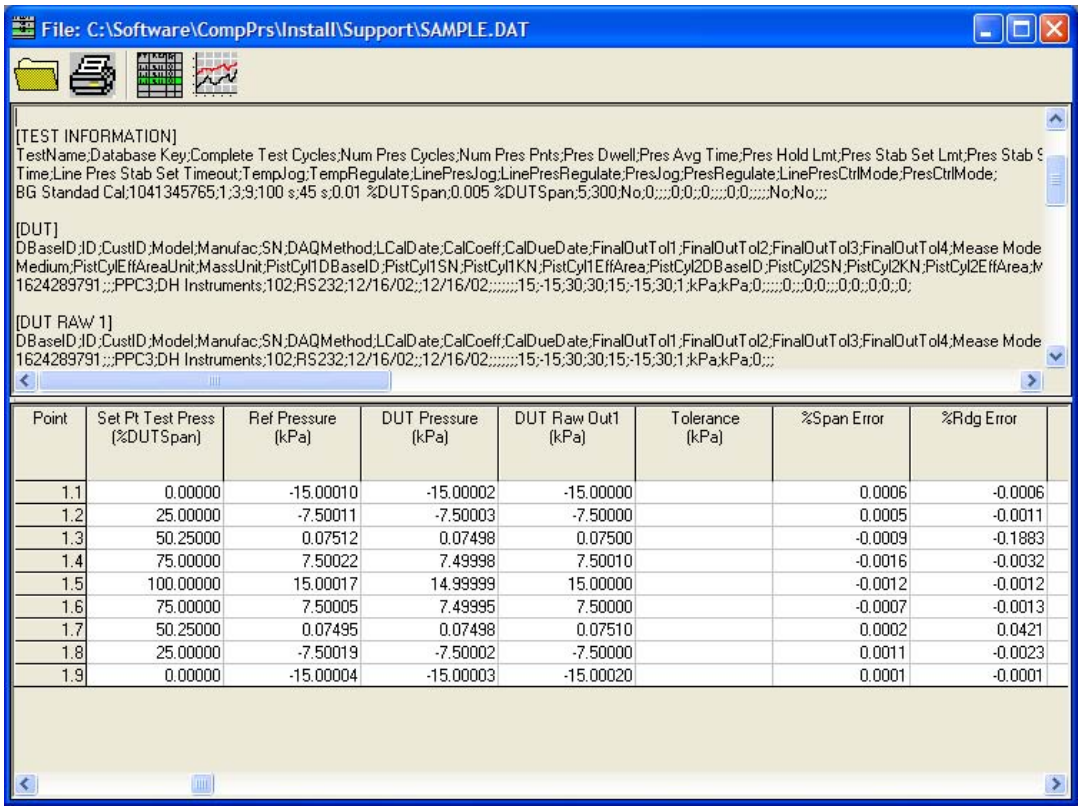
19. [DATA], [VIEW DATA FILE]

19.1 OVERVIEW

When **COMPASS** runs a test, it logs exhaustive test related data in a Data File (*.dat). The Data File is automatically generated and stored to a DUT dependent directory. Data Files can be viewed as raw text in almost any text editor or spreadsheet application. Data Files can be merged with report templates to generate custom test reports. However, there are occasions in which it is desirable to view a Data File without leaving **COMPASS**. For this purpose, the **Data File Viewer** is provided. This tool is accessible using **[Data]**, **[View Data File]**.

When **[Data]**, **[View Data File]** is selected, a standard Windows file browser appears with the default directory set to the root Data File directory. Selecting a Data File causes that file to be opened and displayed in the **COMPASS Data File Viewer**. The **Data File Viewer** provides no formatting. It displays only, there are no options to edit and/or save Data Files using this feature. The name and directory path of the Data File currently being viewed are shown at the top of the window.

While viewing a Data File, a toolbar on the top left of the display is available for new file selection, printing and displaying the test data in a grid format. The function of each toolbar option is described in the table below.



Point	Set Pt Test Press (%DUTSpan)	Ref Pressure (kPa)	DUT Pressure (kPa)	DUT Raw Out1 (kPa)	Tolerance (kPa)	%Span Error	%Rdg Error
1.1	0.00000	-15.00010	-15.00002	-15.00000		0.0006	-0.0006
1.2	25.00000	-7.50011	-7.50003	-7.50000		0.0005	-0.0011
1.3	50.25000	0.07512	0.07498	0.07500		-0.0009	-0.1883
1.4	75.00000	7.50022	7.49998	7.50010		-0.0016	-0.0032
1.5	100.00000	15.00017	14.99999	15.00000		-0.0012	-0.0012
1.6	75.00000	7.50005	7.49995	7.50000		-0.0007	-0.0013
1.7	50.25000	0.07495	0.07498	0.07510		0.0002	0.0421
1.8	25.00000	-7.50019	-7.50002	-7.50000		0.0011	-0.0023
1.9	0.00000	-15.00004	-15.00003	-15.00020		0.0001	-0.0001

Figure 150. Data File Viewer

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Table 64. Data File Viewer Options

FEATURE	DESCRIPTION
Select Data File	Used to pick a different Data File to view. This function is disabled when the Data File is being viewed from the **Test Complete Screen**.
Print Data File	Used to print the Data File that is being viewed using the standard Windows print function and the current default printer.
Toggle Grid	Toggles the display of the **<Data Grid>** inside the data viewer. If the Data File is incomplete, this option is disabled. The data in the grid is equivalent to the data that would be displayed in MS Excel if the proper Data File delimiter were selected.
Plot Data	Plot the current Data File. Refer to section 20, [Data], [Plot Data File], for details on how to use the plot tool.

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20. [DATA], [PLOT DATA FILE]

20.1 OVERVIEW

[Data], **[Plot Data File]** is used to generate plots using data stored in Data Files (*.dat). Use the **COMPASS** Data Viewer to plot data stored in the database. The plots generated may be viewed and/or printed. This function is useful to quickly analyze data. The plots may also be selected for inclusion in **COMPASS** reports. There are several default plots that are installed with **COMPASS**. However any number of custom plots can be created to analyze any data logged by **COMPASS**. Use the toolbar on the plot form to include a tolerance bar, legend or best fit error data.

When **[Data]**, **[Plot Data File]** is selected, a standard Windows file browser appears set to the directory that holds the Data Files. Selecting a file causes the **COMPASS** Plot screen to appear loaded with a plot generated using the data from the Data File.

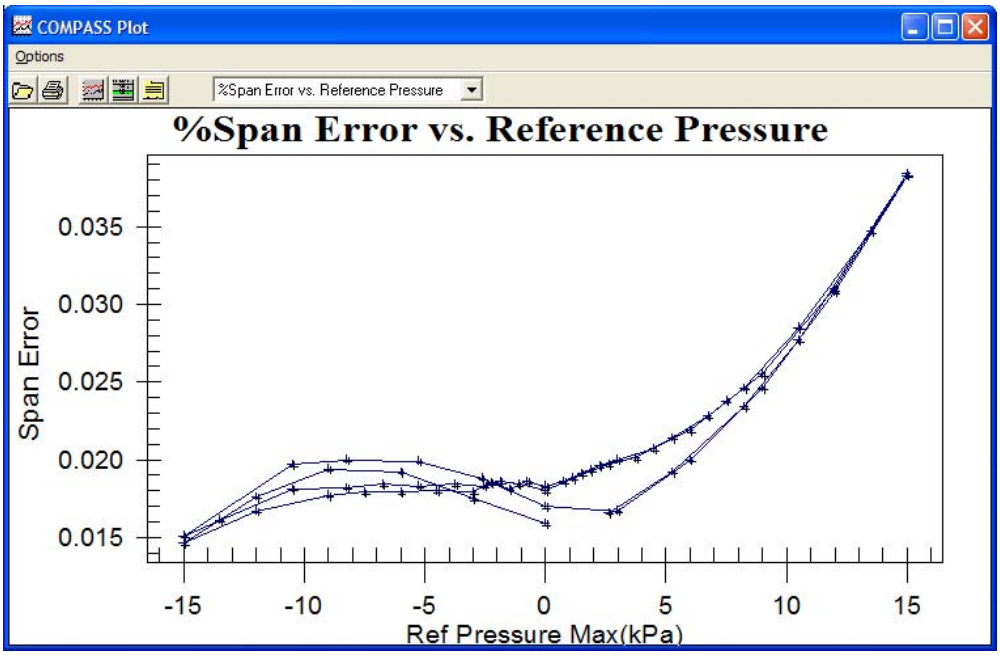

Figure 151. [Data], [Plot Data File] Screen

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20.2 PLOT TOOLBAR

A plot toolbar is provided to select new Data Files, print the current plot, change the type of plot, access common plot properties and create/edit custom plots. Use the list box at the top of the display to change plots. The toolbar features are summarized below:

Table 65. Data Plot Toolbar

FEATURE	DESCRIPTION
Select/Append Data File	Allows selection, using a standard Windows file browser, of a different Data File(s) to be plotted. During test execution, this icon is disabled. Only the current test can be viewed in the plot tool while a test is active.
Print Data File	Allows the graph currently selected to be printed using the standard Windows print function.
Create/Edit Plot	Displays the **Custom Plot Editor** loaded with all existing plots. The editor allows plots to be created, edited and removed (see 20.4, Create/Edit Plots).
Edit Plot Data	Displays an options window to customize the points used for plotting. .
Edit Plot Properties	Displays an options window to customize the points used for plotting. .

20.3 PLOT OPTIONS MENU

An **[Options]** menu is available for use in place of the toolbar when **COMPASS** is not running a test. The options in the menu directly correspond to options on the plot toolbar. In addition there is an **[Add Plot]** option used to add additional Data Files to the plotting tool. This is a useful feature that allows Data Files created at different times to be compared on a single plot.

20.4 CREATE/EDIT PLOTS

All plots used by the plotting tool can be customized using the Custom Plot Editor. Use the toolbar or menu choice to access this tool. The features on this form allow plots to be created, edited and removed.

Editing custom plots follows the same basic editing rules as all other editors within COMPASS. The one exception is that the [Edit] button must be pressed prior to modifying plot properties. Plot properties cannot be modified directly prior to pressing this button.

To edit an existing plot simply select the plot in the list and press the **[Edit]** button. Use the **[New]** toolbar option to create a new plot. Using either of these options puts the editor into edit mode. Only in this state can plot properties be changed. Any combination of test data can be used to generate plots. Always start by entering a **<Plot Description>** that accurately represents the plot. The text entered displays at the top of each plot and is used to select plots. Select the type of plot by changing the state of the **<3D Plot>** check box. Select the data to include on each axis by using the drop down list box next to each axis label. All numeric data logged for each point in the Data File can be used on any plot axis.

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Press the ellipsis button next to the list box to edit the axis text. Make plot property selections at the bottom of the display then press the **[Save]** toolbar button to save the plot. Prior to saving the plot, the color scheme, line type, fonts and many other aspects of the plot can be modified by pressing the **[Properties]** button. This displays the plot properties dialog that allows customization of the non data related plot features.

3D plots cannot be used for any combination of data in the Data File. The data plotted must be related such that one axis value is fairly constant while the other axis values change. This is only possible when accessing Data Files that include multiple cycles. For example a test that executes temperature and pressure points will yield a Data File that can be used to crate an Error, pressure and temperature plot. Data from a single cycle test cannot be used on a 3D plot. In this case, use the secondary Y axis on a 2D plot.

Figure 152 shows the **Custom Plot Editor** loaded with several plots. **Table 66** explains the features available on the form.

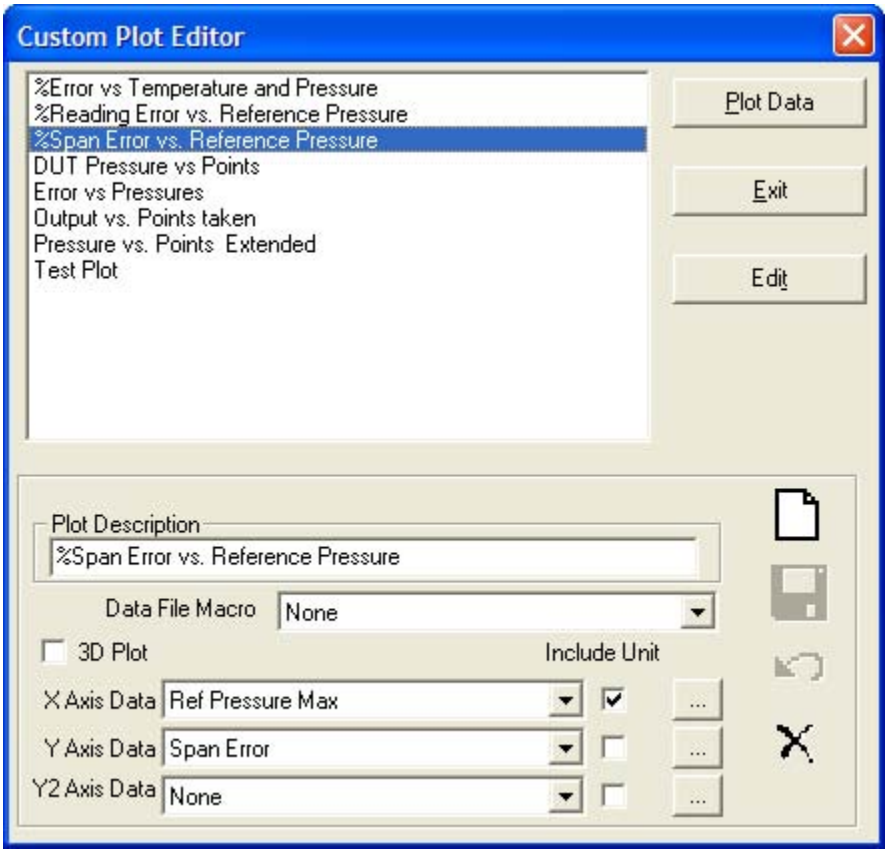

Figure 152. Custom Plot Editor

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Table 66. Custom Plot Editor Fields

FEATURES	DESCRIPTION
Existing Plots (list box)	The list box displays all plots stored in the **COMPASS** database. The plot axis data at the bottom of the display always corresponds to the plot selected in this list.
Plot Data (button)	Use this button to plot the currently selected data plot.
Exit (button)	Closes the **Custom Plot Editor**.
Edit (button)	Begins the editing the currently selected plot. Only when this button is pressed can changes be made to a custom plot.
Properties (button)	Displays the plot properties dialog to allow non data related plot properties to be edited.
Plot Description (required text entry)	Displays the text used select plots and to use as the plot title. Make sure the text in this field accurately represents the selected plot.
Data File Macro (list box selection	Select a macro to execute on the test Data File prior to generating a plot. **Data File Macros** are intended to create temporary columns of data in the Data File or edit existing Data File data.
3D Plot (check box)	Check this box to crate a 3D plot. The box is not checked, it is assumed that a 2D plot will be created.
X Axis Data (list box)	Select the data that will display along the X axis. The text of the selection followed by units (when selected) will appear along the X axis. Press the button next to the drop down list to change the text to associate with **<X Axis Data>**.
Y Axis Data (list box)	Select the data that will display along the Y axis. The text of the selection followed by units (when selected) will appear along the Y axis of the plot. Press the button next to the drop down list to change the text to associate with **<Y Axis Data>**.
Y2 Axis Data (list box)	Select the data that will display along the secondary Y axis. This axis is labeled on the right side of a plot. The text of the selection followed by units (when selected) will appear along the right side of the plot. Press the button next to the drop down list to change the text to associate with **<Y2 Axis Data>**.
Z Axis Data (list box)	Select the data that will display along the Z axis. The text of the selection followed by units (when selected) will appear along the Z axis. Press the button next to the drop down list to change the text to associate with **<Z Axis Data>**.

20.5 PLOT POINTS

Use the toolbar or **[Options]** menu to display the **Plot Points** dialog. The features on this form allow users do select which points, Data Files and point cycles to include in a test data plot. The tabs available on this display vary with the information stored in the Data File.

The **[General]** tab contains features to apply tolerance, subset and legend options. The remaining tabs contain point and cycle values to include in the plot. Check options that you wish to include in the plot and uncheck options that you do not wish to include in the plot.

When the selected plot type uses %Reading Error, %Span Error or DUT Difference on the Y-Axis, an additional tab is available to plot best fit error data. The best fit DUT error is determined using the best fit order selected on the **[Best Fit]** tab. See **Figure 154** and **Table 68** for information on the options on the **[Best Fit]** tab. This is a convenient way of viewing predicted error information. This option is not available for 3D plots and plots with a secondary Y axis. To view best fit data when the **[Best Fit]** tab is not available, use the **Custom Plot Editor** and specify best fit information for an axis in the plot.

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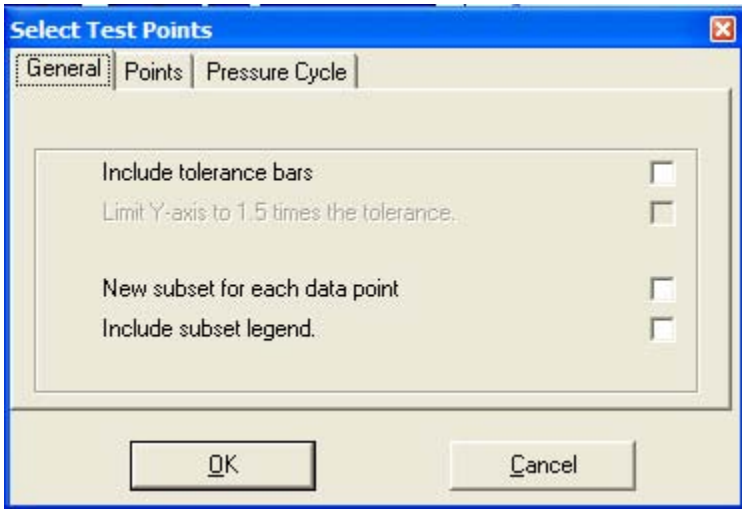

Figure 153. Plot Points display

Table 67. Plot Points Genera Tab Fields

FEATURES	DESCRIPTION
Include tolerance bars (check box)	Causes tolerance bars to be displayed on the graph. The tolerance bars are calculated using the tolerance value stored in the Data File. Tolerance bars are displayed only when plotting errors and or pressure information related to the DUT. Tolerance bars are also not displayed when a secondary Y axis is included in the plot.
Limit Y axis to 1.5X tolerance (check box)	This option is active only when tolerance bars are included in the plot and an error plot type is selected. If the error exceeds the tolerance by 50 %, the actual DUT error plot will not be visible. When this function is not active, all plots are auto-scaled. This option is often used for plots included in reports so that all plots are scaled in the same manner regardless of actual error magnitude.
New subset for each data point (button)	Check this option to create a new subset of points for each pressure point. Use this option to generate lines of data for the same point when multiple cycles are used. For example, a 6 point 6 pressure cycle test would yield 6 lines of data. The error of each point can be plotted to quickly display how error changed at a single point in each cycle. This feature is most useful when each pressure cycle changes the output of the data plotted at the same point. For example, DUT %Span Error vs. Temperature. Each temperature cycle may yield a different DUT pressure error at the same point.
Include subset legend (button)	Check this option to display a legend at the top of the plot to for each subset. Do not check this option when many subsets will be used.

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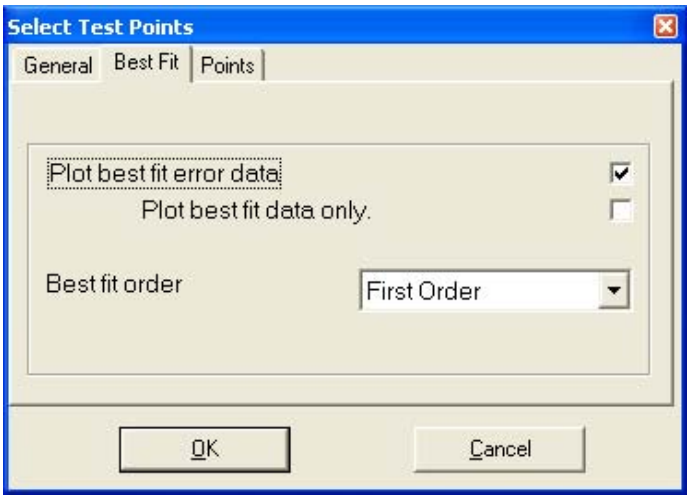

Figure 154. Plot Points Best Fit Tab

Table 68. Plot Points Best Fit Tab Fields

FEATURES	DESCRIPTION
Plot best fit error data (check box)	Check this box to plot best fit error (predicted error) when the selected plot type uses a DUT to reference error on the Y Axis.
Plot best fit data only (check box)	Plot only best fit data when this item is checked. When it is not checked, the original error and best fit error are plotted.
Best fit order (drop down list)	The order of the polynomial fit to use to determine the best fit error. A least squares best fit is used on the DUT and Reference data to determine the polynomial coefficients. The determined values are applied to the DUT data to determine the predicted DUT data. A new error based on the selected plot type is calculated using the predicted DUT data and the reference data.

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21. [DATA], [DATABASE DATA VIEWER]

21.1 OVERVIEW

The **COMPASS** Data Viewer is a simple easy to use interface with which to view, add and remove **COMPASS** data in the Test Data Database. Basic sorting and searching functionality are provided to quickly locate specific test records.

By default, **COMPASS** logs all test data to a delimited text data file. At the end of a test, the data can be added to the database by using the **[Add To Database]** button on the **<Test Complete>** dialog at the end of a test (see 7.4.1, Test Conclusion). In addition, the **[Tools]**, **[Options]**, **[Data File]** tab contains an option to allow test data to be added to the database automatically (see 14.8, [Data File] Tab). In general, only data from valid and complete tests should be added to the database.

The data is stored in an Access database. The common format enables easy manipulation and integration with other databases. Users are welcome to add fields and customize the database as desired. However, if the fundamental structure of the database altered, the Data Viewer will no longer work properly.

21.2 COMPASS DATA VIEWER

The main window of the **COMPASS** Data Viewer is divided into three main sections: Data Viewer Toolbar, Record Navigator and Test Record Information. The Data Viewer Toolbar contains all icons required to view store, select and manipulate data in the Data Viewer, see **Figure 155**. Refer to **Table 69** for details on the functions for each icon.

The Record Navigator is located just beneath the Data Viewer Toolbar. Use this tool to scroll through available data records. Simply click on the arrow for the direction to advance and scroll through the list of records one at a time. The display updates based on the information in the database corresponding to the selected record. To quickly move to the beginning or end of the record set, press the corresponding arrow and slash button. The records available are only those selected by the current query. To view all records use the **[All]** toolbar function. Searches return only records that fit the search criteria and may be zero in size if no matching records are identified.

Data values of –9999 represent data that was not logged in the Data File when imported into the database. Ignore these fields.

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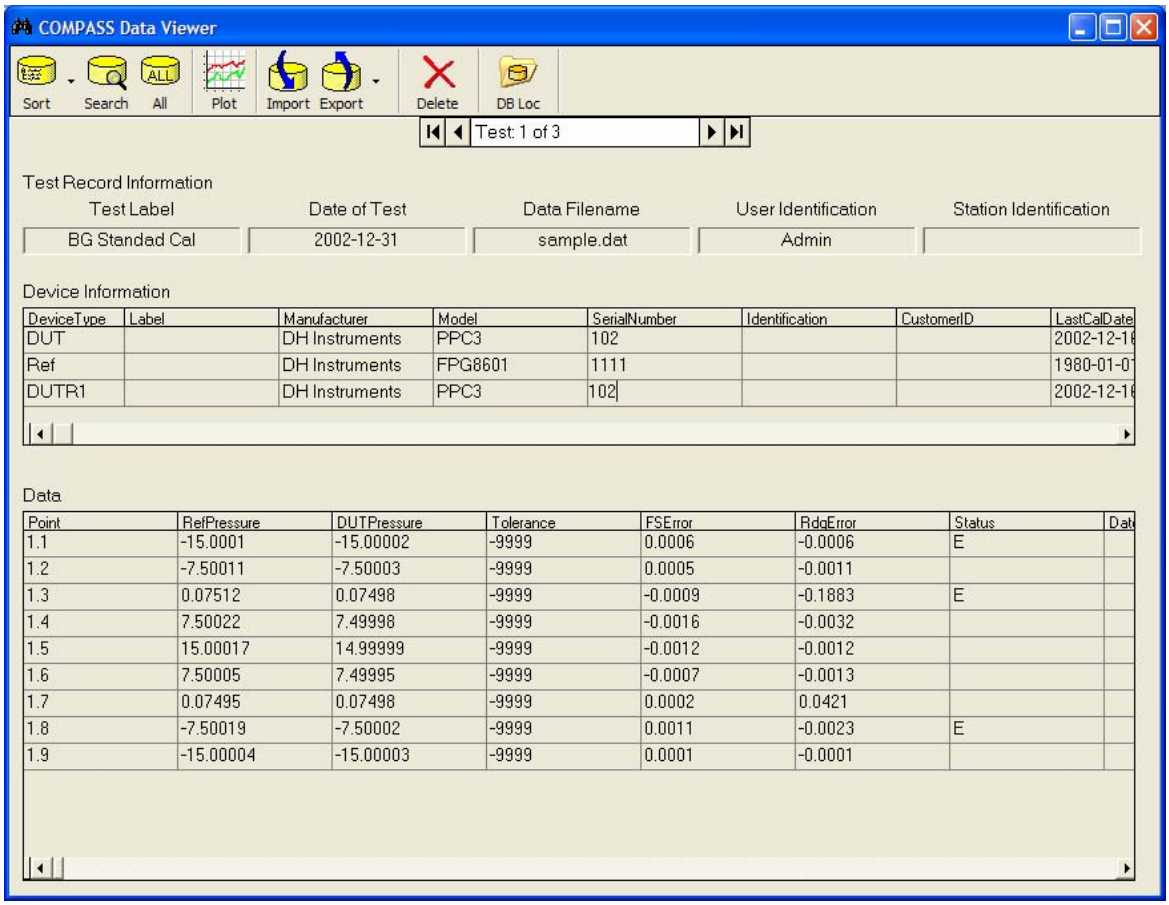

Figure 155. COMPASS Data Viewer main display

Table 69. Data Viewer Toolbar

IMAGE	DESCRIPTION
Sort	Sort the active data set by the test label, test date, data filename, user identification or the station identification.
Search	Opens the Create Search Query window (see 21.4, Create Search Query). Data can be searched by using options on the Query Builder or by direct execution of a SQL query. The query returned sets the active data set.
All	Refreshes the active data set and displays all records contained in the database.
Plot	Opens a separate plot window where the current data is displayed as a plot. The plot is updated to reflect the current record as the user navigates through the database. Refer to section 20, [Data], [Plot Data File], for details on how to use the plot tool.
Import	Click this option to import a supported **COMPASS** data file into the database. Multiple files may be selected.
Export	Exports the current test data to: **COMPASS Data File** – An ASCII Data File is created. The file is formatted identically to the original Data File imported into the database (see 27, Data Files). **XML format** – XML is an increasingly popular data format used in many applications. Any application specifically designed to view XML files can

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IMAGE	DESCRIPTION
	receive files exported in this format. **Fluke™ MET/CAL®** - A source file available for import into the MET/CAL database is created (see 22.3, Export to MET/CAL)
 Delete	Deletes the current test record. *Deleted records are not recoverable. If a record is accidentally deleted, the database may be restored by re-importing the original COMPASS Data File.*
 Database Location	Sets the location of the database. By default, the database location is the value specified in [Database],[Setup] (see 24.2, [Database], [Setup]).

Details of each record are displayed below the **<Test Record Information>** label. General test information is displayed across the form in five labels while devices and data points are displayed in tables below. This information is not meant to be comprehensive but is only intended to quickly identify an individual test. See **Table 70** for details on the information in these fields.

Table 70. Test Record Information Fields

LABEL	DESCRIPTION
Test Label	**COMPASS** Test Definition that was used to perform the calibration.
Data of Test	Date that the calibration was begun.
Data Filename	The original **COMPASS** filename of the data file that was imported into the database.
User Identification	Identifies the individual who performed the calibration.
Station Identification	Indicates where the calibration was performed.
Device Information	Grid contains all devices involved with the calibration. Separate devices are listed by individual row. The function of the device is defined by the "Device Type" column and is defined under the "Devices" table description along with a complete description of other columns. *Only device header information specifically added to the data file is available in this grid (see 14.10, [Data Header] Tab).*
Data	Table lists all test data points individually by row. Test points are listed in order that they were recorded in **COMPASS**. This can be verified with the "Point" column. For a detailed description of each column, refer section 21.5.3, DATA Table. *Only data point information specifically added to the data file is available in this grid (see 14.9, [Data In File] Tab). All other fields display –9999 to represent the absence of data.*

21.3 DATABASE PRINCIPLES

The data is stored in an Access database consisting of three tables: Test, Devices and Data. Data from all three tables combine to hold specific information pertaining to a single test data file. The Test table maintains information regarding the environment and procedures for each test (see 21.5.1, Test Table). The Devices table maintains all the devices used for that particular test including the reference and DUT as well as any other support devices and controllers (see 21.5.2, Devices Table). Only device information specifically selected for output to the data file is available in this section. The Data table houses all the individual test data points for each test (see 21.5.3, DATA Table).

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The database tables are related to one another through the use of a common key value named "TestKey". The TestKey is the unique record identifier for an individual Test table record. This key is auto generated when a data file is added to the database and is present in all tables; Test – TestKey, Devices – ParentTestKey, and Data – ParentTestKey. Each test saved to the database will reside as a single record in the test table, but multiple records will be created in both the Devices and Data tables to store associated information. **Figure 156** displays the table relationship.

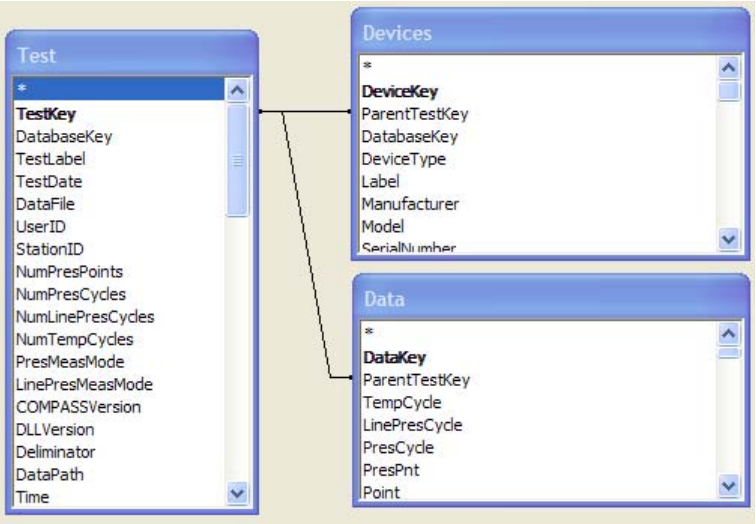

Figure 156. COMPASS Test Data Database Table Links

21.4 CREATE SEARCH QUERY

One advanced function of the **Data Viewer** is the ability to search through the database and extract only certain tests that match a limited criterion. There are two basic ways with which to perform this search: Use the **Query Builder**, or compose an SQL statement. These options are available by selecting the **[Search]** icon on the toolbar. This displays the **Create Search Query** dialog. The **Query Builder** is located in the upper portion of the window. This is a simple interface used for building complex SQL statements. Select the field to limit in the database and then included the criteria to be applied. The SQL statement is automatically created when selections are made. For example, the field "DUT Serial Number" can be selected and the criterion "2803" can be entered. When **[Execute]** is pressed, only test data records that include data from DUTs with serial number 2803 will be displayed. Up to 3 fields can be linked together using **AND** or **OR** to locate a specific test record. Two date fields can be used to search for tests that occurred between a specific date range. Searches are case insensitive and dates must be formatted as mm/dd/yyyy. **Figure 157** contains an example search for all tests created by the user MLF that have occurred since January 25, 2003.

Instead of the Query Builder, an SQL statement can be entered directly in the <SQL Statement> text box. In most cases, editing the statement created by the Query Builder is recommended opposed to creating a statement from scratch.

Creating an SQL statement requires knowledge of the SQL syntax. Any error associated with a SQL statement may cause the search to fail. It is also possible to delete and/or change records or the database structure itself. Ensure that your data is backed up prior to using this feature when the outcome of a query is uncertain.

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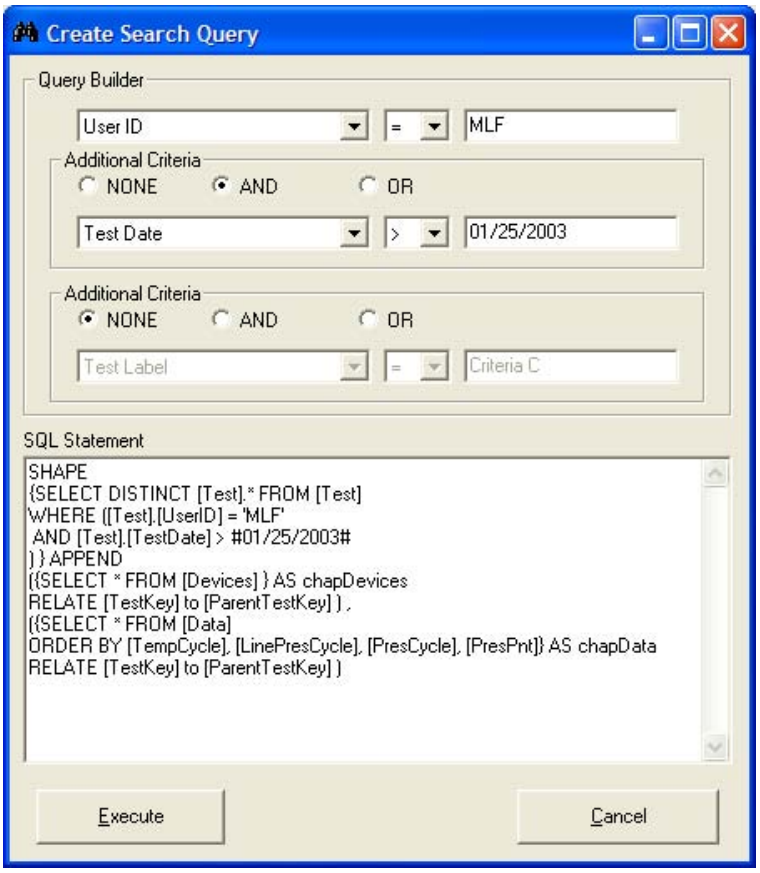

Figure 157. Database Search Setup

21.5 DATABASE TABLES AND FIELDS.

The database consists of three tables, Test, Devices, Data. All tables are linked to a single test through the unique test key as described in 21.3, Database Principles.

21.5.1 TEST TABLE

The test table contains all the information about a test except the device information and individual data points recorded during the test. The “TeskKey” is the primary key for the table and is also the common value that links information across tables (see 21.3, Database Principles). Most fields in this table directly correspond to Test Definition settings. Refer to Section 8, **[Setup], [Test]** for details on these fields. **Table 71** contains an exhaustive list of all fields in the Test table.

Table 71. Description of fields in the Test Table

DATABASE FIELD	DATA TYPE	DESCRIPTION
COMPASSVersion	Text	Version of **COMPASS** that was used to create the data file.
CompleteTestCycles	Integer	Number of pressure cycles completed.
Cycles	Integer	Number of pressure exercise cycles.
DatabaseKey	Long Integer	Location / Key in the **COMPASS** Test/Device Database
DataFile	Text	Filename of the original data file.
DataInfoCollection	Memo	Text Representation of the

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DATABASE FIELD	DATA TYPE	DESCRIPTION
		DataInfoCollection
DataPath	Text	Path to the original data file
Deliminator	Integer	ASCII value of the delimiter used to separate data in the data file.
DLLVersion	Text	Version of the TestData DLL that was used to collect the data.
LastModifiedBy	Text	**COMPASS** user that saved the data to the database.
LastModifiedDate	Date/Time	Date/Time when file was added to the database.
LeakDwell	Integer	Leak test dwell time.
LeakRate	Double	Calculated test leak rate..
LeakRateLimit	Text	Test leak rate criterion.
LeakStatus	Text	Result of the leak test.
LeakTarget	Double	Leak test target pressure
LeakTime	Integer	Leak test time.
LinePresCtrlMode	Text	The line pressure control mode (static/dynamic).
LinePresDwell	Text	Line pressure dwell time.
LinePresHoldLimit	Text	Line pressure hold limit.
LinePresJog	Text	Line pressure jog state (Yes/No)..
LinePresMeasMode	Text	Under what condition is the line pressure measurement made (gauge, absolute)
LinePresRegulate	Text	Line pressure regulation state.
LinePresSSLimit	Text	Line pressure stability limit.
LinePresSSTime	Integer	Line pressure ready hold time.
LinePresSSTimeout	Integer	Line pressure stability timeout.
LinePresUseReady	Text	"Yes" when the line pressure controller's Ready criterion was used remotely and "No" otherwise.
LocalGravity	Double	Value representing local gravity
LocalGravityUnit	Text	Unit of Local Gravity, (m/s^2).
MaxTarget	Text	Maximum target for the test exercise.
MinTarget	Text	Minimum target pressure for the test exercise.
Notes	Memo	General test notes entered by the user at the end of the test.
NumLinePresCycles	Integer	Number of repeated line pressure points
NumPresCycles	Integer	Number of repeated pressure cycles
NumPresPoints	Integer	Number of Individual pressure set points.
NumTempCycles	Integer	Number of repeated temperature points
PresAvgTime	Text	Test pressure averaging time.
PresCtrlMode	Text	Test pressure control mode (static/dynamic).
PresDwell	Text	Test pressure dwell time.
PresHoldLimit	Text	The test pressure hold limit.
PresJog	Text	Test pressure jog state (Yes/No)..
PresMeasMode	Text	Under what condition is the test pressure measurement made (gauge, absolute, ect.)
PresRegulate	Text	Test pressure regulation state.
PresSSLimit	Text	The test pressure stability limit.
PresSSTime	Integer	Test pressure ready hold time.
PresSSTimeout	Integer	Test pressure stability timeout.

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DATABASE FIELD	DATA TYPE	DESCRIPTION
PresUseReady	Text	"Yes" when the controller's Ready criterion was used remotely and "No" otherwise.
PreTestUnits	Text	List of units that correspond to leak test values.
StationID	Text	Identifies the station / location where the test was performed.
TempDwell	Text	Test temperature dwell time.
TempHoldLimit	Text	The temperature hold limit.
TempJog	Text	Temperature jog state (Yes/No).
TempRegulate	Text	Temperature regulation state.
TempSSLimit	Text	The temperature stability criterion.
TempSSTime	Integer	The temperature ready hold time.
TempSSTimeout	Integer	The temperature stability timeout.
TempUseReady	Text	"Yes" when the temperature controller's Ready criterion was used remotely and "No" otherwise.
TestDate	Date/Time	Date when the test was started.
TestKey	Long Integer	Primary key identifying individual tests.
TestLabel	Text	Test Definition Record Label.
Time	Date/Time	Time when the test was started
UserID	Text	Individual technician performing the test.

21.5.2 DEVICES TABLE

All devices used in a test can be recorded in the data file and the devices table. The role each device played in the test is identified as the **Device Type**. Only devices specifically added to the data file will be added to the Devices table in the database (see 14.10, [Data Header] Tab). **Table 72** describes the different device types.

Table 72. Device Type Descriptions

DATABASE CONSTANT	DESCRIPTION
aPres	Ambient Pressure
aRH	Ambient Relative Humidity
aTemp	Ambient Temperature
Aux1	Auxiliary 1
Aux10	Auxiliary 10
Aux2	Auxiliary 2
Aux3	Auxiliary 3
Aux4	Auxiliary 4
Aux5	Auxiliary 5
Aux6	Auxiliary 6
Aux7	Auxiliary 7
Aux8	Auxiliary 8
Aux9	Auxiliary 9
DUT	Device Under Test
DUTR1	DUT Raw Output 1
DUTR2	DUT Raw Output 2
DUTR3	DUT Raw Output 3
Ref	Reference

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DATABASE CONSTANT	DESCRIPTION
RefR1	Reference Raw Output 1
RefR2	Reference Raw Output 2
RefR3	Reference Raw Output 3
rLPres	Read Line Pressure
rTemp	Read Temperature
sLPres	Set Line Pressure
sPres	Set Pressure
sTemp	Set Temperature

Table 73. Description of fields in the Devices Table

DATABASE FIELD	DATA TYPE	DESCRIPTION
CalDueDate	Date/Time	Date next calibration is due after current calibration is completed
CalibrationCoefficient1	Text	User calibration correction applied last time.
CalibrationCoefficient2	Text	User calibration correction applied last time.
CalibrationCoefficient3	Text	User calibration correction applied last time.
CalibrationCoefficient4	Text	User calibration correction applied last time.
CalibrationCoefficient5	Text	User calibration correction applied last time.
CalibrationCoefficient6	Text	User calibration correction applied last time.
CustomerID	Text	Identifies the original owner
DAQMethod	Text	Method which was used to communicate with the device during the test
DatabaseKey	Long Integer	Location / Key in the **COMPASS** Test/Device Database
DeviceKey	Long Integer	Primary Key for Table
DeviceType	Text	Designates what the device was used for in the test (ie DUT, REF, AUX...)
DWTGravity	Double	Gravity value used by a DWT (Deadweight Tester)
DWTGravityUnit	Text	Unit of DWT Gravity
FinalOutputMax	Double	Maximum value attainable by the device.
FinalOutputMin	Double	Minimum value attainable by the device
FinalOutputSpan	Double	Difference between the maximum and minimum final outputs of the device.
FinalOutputTolerance1	Text	Primary output tolerance statement for device.
FinalOutputTolerance2	Text	Additional output tolerance statement for the device
FinalOutputTolerance3	Text	Additional output tolerance statement for the device
FinalOutputTolerance4	Text	Additional output tolerance statement for the device
FinalOutputUnit	Text	Final Output Unit
HeadHeight	Double	Height above the base of the instrument where the measurement is said to represent.
HeadMedium	Text	Medium which is measured by the device (air, N2, water, oil...)
HeadUnit	Text	Unit of measure (distance) for the head height.
Identification	Text	User assigned ID or description
Label	Text	Device label used to describe the device
LastCalDate	Date/Time	Date the device was last calibrated, prior to current date.
Manufacturer	Text	Manufacturer of the device
MassBellDatabaseID	Long Integer	Database Identifying the Bell in the **COMPASS** Device database
MassBellMass	Double	Mass of Bell
MassBellSerialNumber	Text	Serial number for Bell
MassSetDatabaseID	Long Integer	Database Identifying the Mass Set in the **COMPASS** Device database

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DATABASE FIELD	DATA TYPE	DESCRIPTION
MassSetSerialNumber	Text	Serial number of the mass set
MassSetTotalLoad	Double	Sum of all the masses in the mass set
MassUnit	Text	Unit of mass that describes all Piston, Mass Set and Mass Bell masses
MeasMode	Text	Mode in which the device was operated (Abs / Gauge)
Model	Text	Model number / description of the device
ParentTestKey	Long Integer	Link to a specific test
PistCyl1DatabaseID	Long Integer	Database Identifying the 1st Piston in the **COMPASS** Device database
PistCyl1EffectiveArea	Double	1st Piston Effective Area
PistCyl1KN	Text	1st Piston's KN
PistCyl1SerialNumber	Text	1st Piston's serial number
PistCyl2DatabaseID	Long Integer	Database Identifying the 2nd Piston in the **COMPASS** Device database
PistCyl2EffectiveArea	Double	2nd Piston Effective Area
PistCyl2KN	Text	2nd Piston's KN
PistCyl2SerialNumber	Text	2nd Piston's serial number
PistCylEffAreaUnit	Text	Unit of piston cylinder effective areas
RawOutputMax	Double	Maximum of Raw Output
RawOutputMin	Double	Minimum of Raw Output
RawOutputRelationship	Text	Method with which the raw output is converted into the final output
RawOutputSpan	Double	Difference between the maximum and minimum raw outputs of the device.
RawOutputUnit	Text	Unit of Raw Output
SerialNumber	Text	Serial number of device
Span	Double	Difference between the extreme measurement limits of the device. Used in calculations.

21.5.3 DATA TABLE

Data contained in this table represents each point of data that was recorded while performing a test. Data is listed by the order of pressure, line pressure and temperature cycles recorded. Information in this table is not searchable with the **<Query Builder>**, but custom SQL statements may be written and applied to this table.

With the exception of the database specific fields, DataKey and ParentTestKey, all data in this table can be logged in test data files. Options are provided in COMPASS to limit the data logged to the data file and displayed on the data grid. See 14.9([Data In File] Tab) and 14.7([Data Grid] t) for more information on limiting the data logged in files and displayed on the data grid.

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Table 74. Description of fields in the Data Table

DATABASEFIELD	DATA TYPE	DESCRIPTION
AmbientHumidity	Double	Relative humidity measured by the Relative humidity device or entered by the user.
AmbientPressure	Double	Ambient pressure measured by the ambient pressure device or entered by the user.
AmbientTemperature	Double	Ambient temperature measured by the ambient temperature device or entered by the user.
Aux1Final . Aux10Final	Double	Final output value to auxiliary device if present. Up to 10 auxiliary devices can be used in a test.
Aux1Raw . Aux10Raw	Double	Raw output value for auxiliary device if present. Up to 10 auxiliary devices can be used in a test.
DataKey	Long Integer	Primary Key for this table
Date	Text	Date the data point was recorded.
DUTCounts	Integer	Number of measurements used to determine the average DUT pressure value
DUTID	Long Integer	**COMPASS** Device Database Key for the Reference
DUTMass	Double	Total DUT mass loaded at this point. This field applies to piston gauge and deadweight tester type DUTs only.
DUTMassList	Text	List of individual masses currently loaded on the DUT. Each mass is delmited by a colon, ":". For example, "piston:bell:5kg:1kg".
DUTMaxPressure	Double	Maximum pressure value recorded while averaging the DUT pressure
DUTMinPressure	Double	Minimum pressure value recorded while averaging the DUT pressure
DUTPistonPosition	Double	Position of the piston at the time of measurement.
DUTPistonRotation	Double	Speed at which DUT mass was rotating when the measurement was recorded.
DUTPressure	Double	Pressure as recorded by the DUT.
DUTRawOutput1	Double	Value of the DUT's Raw Output 1
DUTRawOutput2	Double	Value of the DUT's Raw Output 2 (when applicable).
DUTRawOutput3	Double	Value of the DUT's Raw Output 3 (when applicable).
DUTReferenceVacuum	Double	Value of vacuum used by the DUT
DUTStnDev	Double	Standard Deviation of the DUT pressure measurement.
DUTTemperature	Double	Temperature viewed/recorded by DUT
ElapsedTime	Double	Elapsed time in seconds from the start of the test.
FinalLinePres	Double	Line pressure measured by the reference line pressure device.
FinalTemperature	Double	Temperature measured by the reference temperature device.
FSError	Double	Difference between the reference and DUT measurements divided by the span of the DUT presented as a percentage.
LinePresCycle	Integer	Line Pressure Cycle (Used to Import Data into Test Data Class DataPointCollection clsDataPoint)
ParentTestKey	Long Integer	Link to a specific test Primary Key
Point	Text	Text that is used to differentiate separate data points.
PresCycle	Integer	Pressure Cycle (Used to Import Data into Test Data Class DataPointCollection clsDataPoint)
PresPnt	Integer	Individual Pressure Point (Used to Import Data into Test Data Class DataPointCollection clsDataPoint)
RdgError	Double	Difference between the reference and DUT measurements

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DATABASEFIELD	DATA TYPE	DESCRIPTION
		divided by the reference pressure presented as a percentage.
RefCounts	Integer	Number of measurements used to determine the average reference pressure value
RefID	Long Integer	**COMPASS** Device Database Key for the reference.
RefMass	Double	The total mass load of the reference. This field applies to piston gauge and deadweight tester type DUTs only.
RefMassList	Text	List of individual masses currently loaded at the point. Each mass is delmited by a colon, ":". For example, "piston:bell:5kg:1kg".
RefMaxPressure	Double	Maximum pressure value recorded while averaging the reference pressure
RefMinPressure	Double	Minimum pressure value recorded while averaging the reference pressure
RefPistonPosition	Double	Position of the piston at the time of measurement.
RefPistonRotation	Double	Speed at which reference mass was rotating when measurement was recorded
RefPressure	Double	Pressure as recorded or generated by the reference.
RefRawOutput1	Double	Value of the 1st reference raw output.
RefRawOutput2	Double	Value of the 2nd reference raw output (when applicable).
RefRawOutput3	Double	Value of the 3rd reference raw output (when applicable).
RefReferenceVacuum	Double	Value of vacuum used by the reference
RefStnDev	Double	Standard Deviation of the reference pressure measurement.
RefTemperature	Double	Temperature viewed/recorded by the reference.
SetErrorFS	Double	Difference between the set pressure and actual reference pressure divided by the span of the DUT presented as a percentage.
SetErrorRdg	Double	Difference between the set pressure and actual reference pressure divided by the reference pressure presented as a percentage.
SetPointLinePres	Double	Line pressure set point specified by the Test Definition.
SetPointPressure	Double	Test pressure set point specified by the Test Definition.
SetPointTemperature	Double	Temperature set point specified by the Test Definition.
SetTime	Integer	Time required to achieve a ready condition when setting the test pressure.
Status	Text	Text flags that describe the test point: T – The DUT was out of tolerance. t – The test pressure was not set within the specified pressure set timeout. E - An error occurred either in a macro or while reading an instrument.
TempCycle	Integer	Temperature Cycle (Used to Import Data into Test Data Class DataPointCollection clsDataPoint)
Time	Text	Time the data point was recorded.
Tolerance	Double	The tolerance of the DUT in pressure units at this reference pressure
UserDefined1 **.** **UserDefined10**	Double	Special value created as a result of a **COMPASS** macro.
VentPoint	Text	Indicates if the value of a given test point was defined by a vent.

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NOTES

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22. EXPORTING COMPASS DATA

22.1 OVERVIEW

Data generated by running tests in **COMPASS for Pressure** can be used in other applications if desired. In most cases the external application will include features necessary to import ASCII data or data stored in a database. Knowing the file and database format of **COMPASS** data is all that is necessary to import the data. Review sections 21.5 (Database Tables and Fields.) and 27.3 (Data File Structure) for details on the structure of data stored in the database and in ASCII data files, respectively.

The following sections describe methods used to export data into applications frequently used with **COMPASS for Pressure**.

22.2 EXPORT TO EXCEL®

There are no direct features within **COMPASS** to export data into Microsoft™ Excel. However, Data Files created by **COMPASS** can be used within Excel by using Excel's import option. Once the data is in an Excel Worksheet, all normal spreadsheet functions are available to manipulate the data as desired. Avoid overwriting the original **COMPASS** Data File with a file edited with Excel, it will no longer be compatible with **COMPASS**. Use the **[File]**, **[Save As]** option in Excel to save the spreadsheet under a different name.

To open a file within Excel, select **[File]**, **[Open]**, locate and select the Data File that you would like to import. Excel will open the Text Import Wizard. Select the "Delimited" option, and the "Next" button. Choose the "semicolon" delimiter (or other selected delimiter) and complete the action by pressing the **[Finish]** button. These steps are detailed below.

A licensed copy of Microsoft Excel is required.

- Run a test in **COMPASS** to generate the desired test data. Make sure that the desired data is logged to the data file by noting the data file options in **COMPASS** (see 14.9). If a Data File is already available, this step is not necessary.
- Run Microsoft Excel and choose the **[File]**, **[Open]** option within Excel. A standard file selection box will display to allow the desired test data file to be selected.
- **COMPASS** test data files have an extension of ".dat". The files displayed in the file selection box are not filtered to include this type of file. To view **COMPASS** data files enter the text "*.dat" into the **<File Name>** field. Then navigate to the desired Data File directory. By default, Data Files are stored in the directory "\Program Files**COMPASS for Pressure**\Data". The exact location is controlled by the **[Tools]**,**[Options]**, **[Data File] Tab**.

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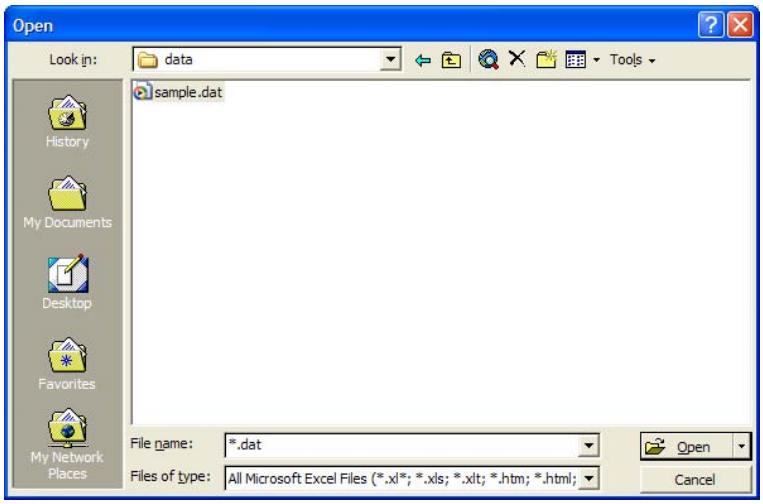

Figure 158. Export To Excel: Changing File Filter to *.dat

- Select the desired Data File. The Text Import Wizard in Excel will display to complete the remaining steps. Select **<Delimited>** to flag that the data file is delimited then press **[Next]**.

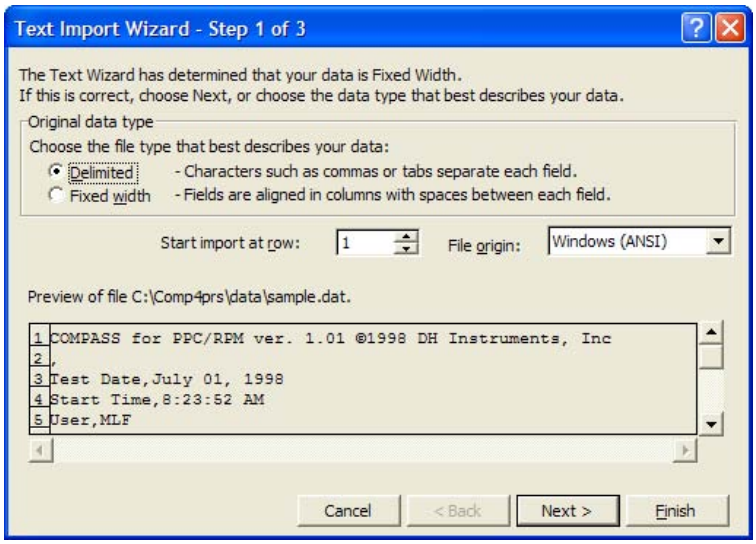
Text Import Wizard - Step 1 of 3
The Text Wizard has determined that your data is Fixed Width.
If this is correct, choose Next, or choose the data type that best describes your data.
Original data type
Choose the file type that best describes your data:
Delimited - Characters such as commas or tabs separate each field.
Fixed width - Fields are aligned in columns with spaces between each field.
Start import at row: 1
File origin: Windows (ANSI)
Preview of file C:\Comp4prs\data\sample.dat.
1 COMPASS for PPC/RPM ver. 1.01 ©1998 DH Instruments, Inc
2 ,
3 Test Date,July 01, 1998
4 Start Time,8:23:52 AM
5 User,MLF
Cancel
< Back
Next >
Finish

Figure 159. Export To Excel: Delimiting Data File

- By default **COMPASS** Data Files are semicolon delimited. Select the delimiter on the list of delimiting choices. The data in the bottom of the display will separate into multiple columns when the correct delimiter is selected. Press **[Finish]** when the correct delimiter is used.

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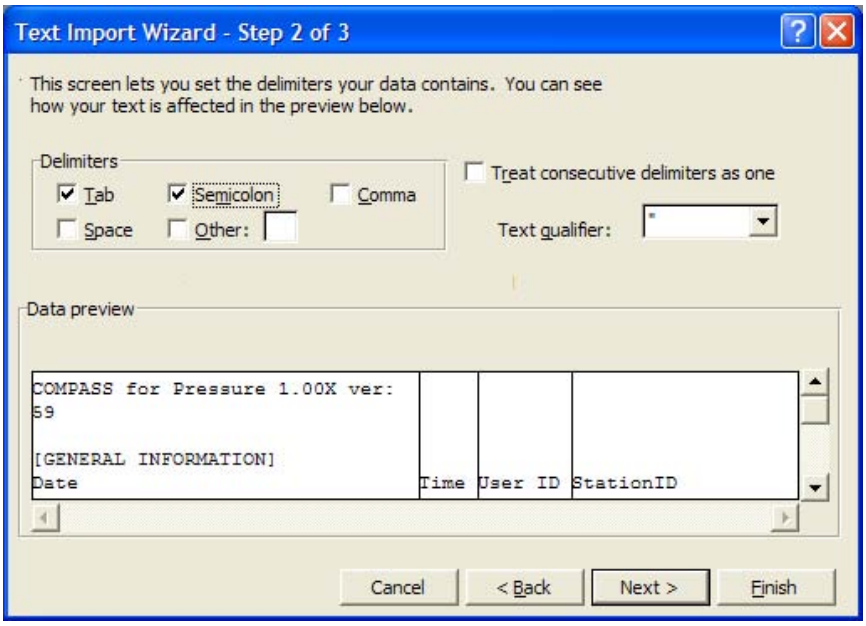

Figure 160. Export To Excel: Selecting the Data File delimiter

- The contents of the Data File will display in individual rows and columns on a single worksheet within Excel. All normal spreadsheet manipulation can be performed on the data file.

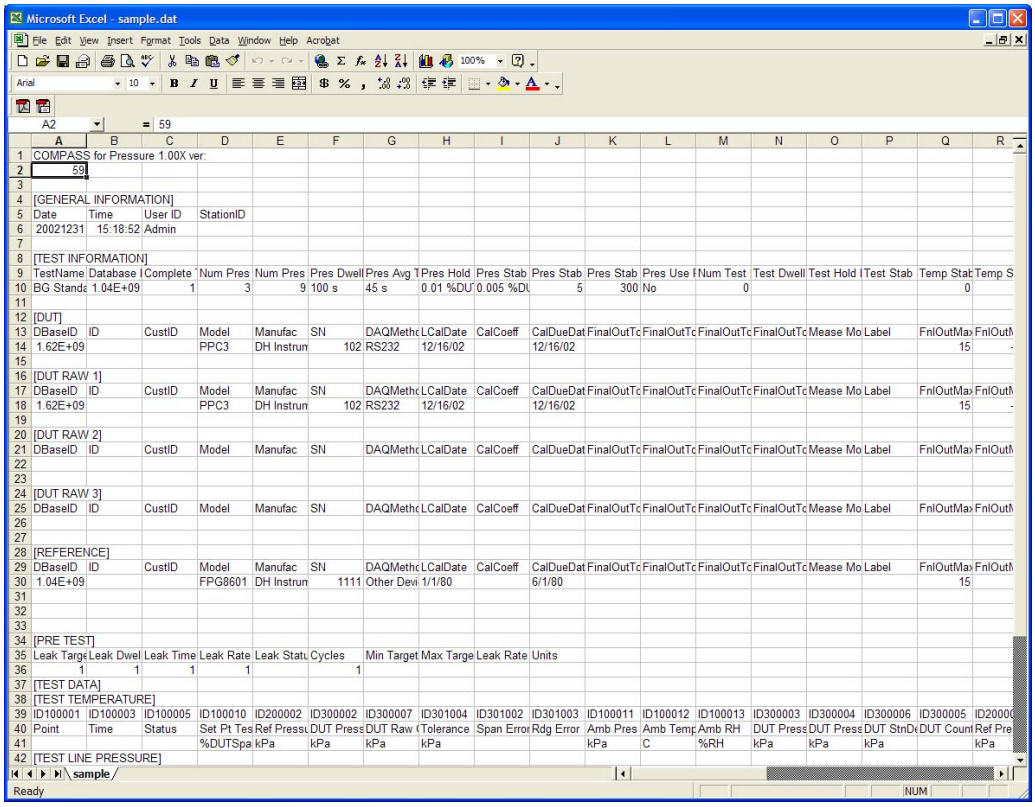

Figure 161. Export To Excel: Data File displayed in Excel

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22.3 EXPORT TO MET/CAL

MET/CAL® is a popular calibration data acquisition and tracking application. Features in MET/CAL allow data acquired from other sources to be manually or directly imported. The **[Data]** menu option in the **COMPASS** main program and the **[Export]** option in the **COMPASS** Data Viewer include features to assist users who wish to import data generated by **COMPASS** into MET/CAL.

This document assumes that the user is familiar with MET/CAL and its operation. This document is not intended to be a replacement for the MET/CAL User's Manual. The information contained in this section specifically describes how data generated by COMPASS can be added to MET/CAL.

COMPASS was specifically tested with MET/CAL+ 7.01. This procedure may require changes to work with older versions of MET/CAL.

To synchronize COMPASS setup information with MET/CAL setup information, the DUT (UUT) <Identification> field on the [Header] tab of the DUT Editor must contain the asset number of the DUT setup in the MET/CAL database. If these fields do not match, test data cannot be imported.

COMPASS for Pressure data is imported into MET/CAL by converting the Data File into a MET/CAL source file. By default, the source file is named the same as the original data file with a ".src" extension. This source file can be directly imported into MET/CAL by using MET/CAL's import data tools. This procedure works only if the date, time and DUT Identification information stored in the **COMPASS** Data File corresponds to a Calbration Record in the MET/CAL database. Therefore a Calibration Record in MET/CAL must be created prior to importing the Data File. At this point the data can be imported as a complete text file, or into individual fields in the Results table of the MET/CAL database.

22.3.1 CREATING THE CALIBRATION RECORD

Prior to importing data into the MET/CAL database, a MET/CAL Calibration Record must be defined. This section describes how to create the Calibration Record.

It is import to remember the calibration time and date as it will be used by COMPASS for Pressure and MET/CAL's Import Tool to automatically synchronize the data with the calibration.

- Run Met/Track and choose the **[Add]**, **[Calibration Record]** menu choice.
- The New Calibration Record dialog displays (see **Figure 162**). Enter all calibration information pertaining to the calibration used to generate the Data File. The most important entries are the specific **<Cal-Date>** and **<Cal-Time>**. Record the entries to these fields for later use. Refer to MET/CAL's User's Manual for additional information on creating and using Calibration Records.

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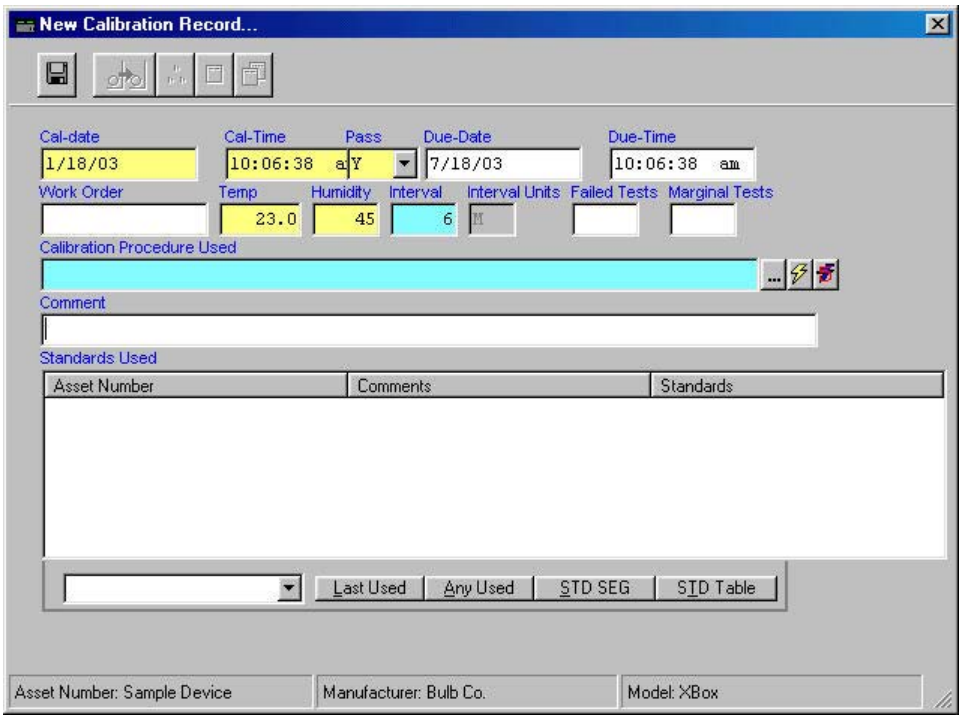

Figure 162. New Calibration Record Editor

22.3.2 CREATING A MET/CAL SOURCE FILE

A MET/CAL source file can be created by using the **[Data]**, **[Export to MET/CAL]** menu choice in the **COMPASS** main program, or by using the **[Export]** option in the **COMPASS** Data Viewer (see 21.2, COMPASS Data Viewer). After selecting the Data File to import the Export to MET/CAL dialog displays (see **Figure 163**). Enter the calibration date and time that correspond to the desired calibration record date and time (see 22.3.1, Creating the Calibration Record). Dates should be formatted as MM/DD/YY and times formatted as HH:MM:SS.

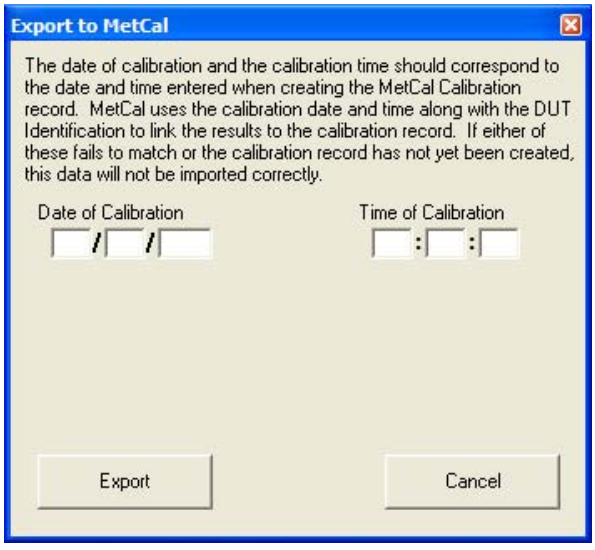
Export to MetCal
The date of calibration and the calibration time should correspond to the date and time entered when creating the MetCal Calibration record. MetCal uses the calibration date and time along with the DUT Identification to link the results to the calibration record. If either of these fails to match or the calibration record has not yet been created, this data will not be imported correctly.
Date of Calibration
Time of Calibration
Export
Cancel

Figure 163. Export to MET/CAL form

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Press the **[Export]** menu option to create the MET/CAL Source file. By default, the file is saved with the same name and location as the original data file with a ".src" file extension. This file must be created prior to importing data into the Results table of the MET/CAL database. Select the newly created file when prompted by the MET/CAL Import Tool when importing data (see 22.3.4, Importing specific data into Results table).

22.3.3 IMPORTING COMPLETE TEST RECORD

A copy of the complete **COMPASS** Test Data File can be saved as an archive in the MET/CAL database. Data imported with this method will not be available for use in MET/CAL reports. It is merely an archiving procedure. The data can easily be extracted at a later date if desired. Follow the steps below to import a complete Data File:

- Open or edit a Calibration Record by using the **[Add]**, **[Calibration Record]** or **[Edit]**, **[Calibration Record]** menu choice. Follow section 22.3.1, Creating the Calibration Record, to create a new record. When editing an existing calibration, locate the correct calibration by the calibration date and time.
- Select the **[Edit Calibration Results]** icon (see **Figure 164**).

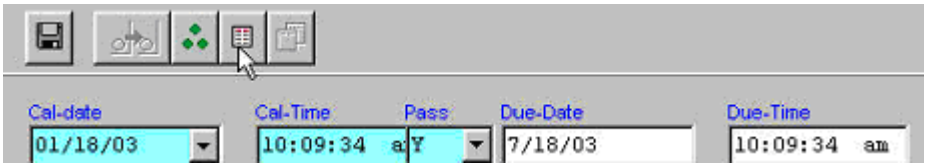

Figure 164. Edit Calibration Results Option

- A separate Calibration Results form will display. This form includes the option to enter calibration results as text. Add the Data File by pressing the **[Import Calibration Results]** icon and selecting the **COMPASS** Data File to import (see **Figure 165**). Alternatively cut and paste the Data File into the Calibration Results window. To use this method, first open the Data File in the **COMPASS** Data Viewer or in any text editor such as Notepad (see 19, [Data], [View Data File]). Highlight and copy the text contents by first clicking the text data displayed, pressing **{CTRL+A}** (select all) followed by **{CTRL+C}** (copy). Click the text display in the Calibration Window and press **{CTRL+V}** (paste).
- Press the **[Save]** option and close the Calibration Results form. The complete data file is stored in the MET/CAL database.

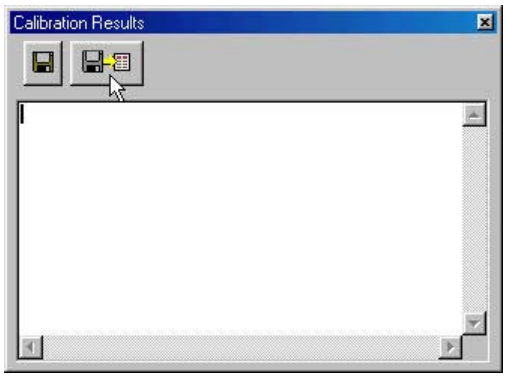

Figure 165. Calibration Results as Text Option

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Follow the steps below to re-create the Data File. This may be necessary to analyze the data using the **COMPASS** Report Editor or to manipulate the data in a spreadsheet.

- Access the DUT (UUT) by using the **<Instrument Browser…>**.
- Select the [Calibration] tab and press the [Show Calibration Results] icon.
- Cut and paste the displayed results into a text editor and save the file with a ".dat" extension. To copy the data, first click the displayed values and press **{CTRL+A}** followed by **{CTRL+C}** to copy the display to the clipboard. The text editor Notepad found in the Windows **[Programs]**, **[Accessories]** group is the recommended tool. Click the text display in Notepad and press **{CTRL+V}** to paste the data. Save the file to complete the process.

22.3.4 IMPORTING SPECIFIC DATA INTO RESULTS TABLE

A Calibration Record and source file must be created prior to importing data into the database. Not all data logged by **COMPASS** can be added to the MET/CAL database. See **Table 75** for the specific fields imported. The most common fields were selected. Once imported, data can be used within MET/CAL in any way desired.

Follow the steps below to import data into the Results Table:

- Run Met/Track and choose the **[Tools]**,**[Import]** menu option. This will open the Import Tool (see **Figure 166**).

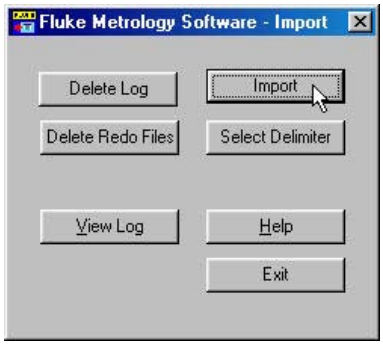

Figure 166. MET/CAL Import Tool

- Select the correct delimiter prior to importing the data. The delimiter is the character that separates data from one another in each line of text. If this is set incorrectly the data will not import correctly. **COMPASS** uses a semi-colon (";") delimiter by default. Options in **COMPASS** are provided to change the file delimiter (see 14.8, [Data File] Tab). When in doubt, verify the delimiter by reviewing the Data File in the **COMPASS** Data Viewer (see 21.2, COMPASS Data Viewer).
- After the delimiter is set, press the **[Import]** button to display the Automated Data Entry form (see **Figure 167**). Two files must be selected in this screen: the Definition File and the Source File. The **<Definition file>** dictates how the data will be imported into database tables and fields. This file is installed in the root directory of **COMPASS for Pressure** during installation (C:\Program Files**COMPASS for Pressure**). The filename of the definition file is "**COMPASSp.def**". The **<Source file>** is created by following the steps outlined in 22.3.2, Creating a MET/CAL Source File). This is a specific Data File formatted to support data importing in conjunction with the **COMPASS** definition file. Select **[OK]** to complete the setup and import the data.

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The COMPASSp.def should not be edited. The file is custom formatted to support the importing of .src files created with COMPASS. If this file is changed, it is up to the user to create source (.src) file to use for importing.*

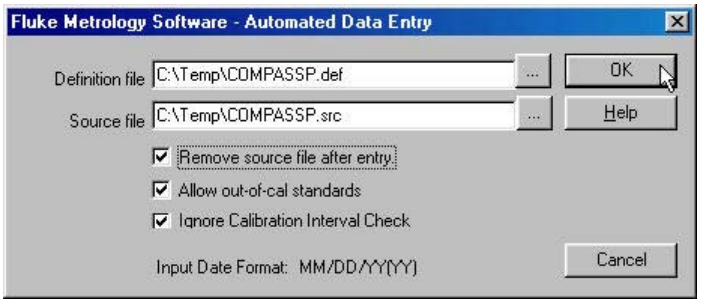

Figure 167. Automated Data Entry Form

- The data outlined in **Table 75** is now available in MET/CAL.

Only test data is imported. No device or test information is updated or replaced with the imported file.

Below is a description of the **COMPASS** definition file and how it translates **COMPASS** data fields to those used by MET/CAL. For additional information on MET/CAL Results Fields refer to the Results Table Reference included with MET/CAL's documentation.

Table 75. Data Imported into MET/CAL

DEFINITION FILE			COMPASS DATA FIELD	DATA EXAMPLE
FULLRESULTS				
4201	UUT Asset#		DUT Identification	PPC3#117
2301	CalDate			03/03/03
2333	CalTime			01:30:47
row_num	Row Number		Index of Rows	1
test_desc	Test Description		Test Label	PPC3 Abs Cal
test_step	Test Step		Point	1.1.1.1
cpt	Cardinal Point		Set Point Pressure	103
cpt_p	Unit Prefix			k
cpt_u	Unit		Unit	P
sys_actual	System Actual		Reference Pressure	103.1213
sys_actual_p	Unit Prefix			k
sys_actual_u	Unit		Unit	P
uut_ind	UUT Indicated		DUT Pressure	103.1224
uut_ind_p	Unit Prefix			k
uut_ind_u	Unit		Unit	P
measurement	Measurement		DUT Raw Output1	4.02
measurement_p	Unit Prefix			m
measurement_u	Unit		Unit	A
tol	Tolerance		Tolerance	0.0002
tol_p	Unit Prefix			k
tol_u	Unit		Unit	Pa
dev	Deviation		DUT – Ref	0.0009

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DEFINITION FILE	MET/CAL RESULTS FIELD		COMPASS DATA FIELD	DATA EXAMPLE
dev_p	Unit Prefix			k
dev_u	Unit		Unit	P
test_status	Test Status		Status	OK
num_meas	Number of Measurements		DUT Counts	12
sdev	Standard Deviation		DUT Standard Deviation	0.0023
sdev_p	Unit Prefix			k
sdev_u	Unit		Unit	P
uut_range	UUT Range		DUT Span	1000
uut_range_p	Unit Prefix			k
uut_range_u	Unit		Unit	P
meas_flag	Measurement Flag		1	1

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NOTES

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23. [DATA], [REPORT EDITOR]

23.1 OVERVIEW

The **COMPASS** Report Editor is used to generate reports from **COMPASS** *.dat files and data stored in the **COMPASS** Test Data database. The **COMPASS** Report Editor provides the features to create, view and edit reports and templates. The Report Editor is essentially a customized word processor and as such, navigation and use is intuitive to users familiar with other word processors. During the report generation process, user defined templates are merged with **COMPASS** Data Files to create final reports. These newly generated reports may be saved as Microsoft Word documents or PDF documents if Adobe Acrobat is installed.

The **COMPASS** Report Editor is accessed by: selecting the **[Data]**, **[Report Editor]** menu option in **COMPASS**, pressing the **[Generate Report]** button in the Test Complete form at the end of a test, or run directly by selecting the **COMPASS** Report Editor icon in the **COMPASS for Pressure** program group. In all cases the Report Editor runs as a separate application and may be closed at any time without affecting the operation of **COMPASS for Pressure**.

23.2 REPORT PRINCIPLES

The **COMPASS** Report Editor is used to create templates (*.tpl) that are merged with data (*.dat) files to generate reports. Multiple templates are created in order to support a variety of report styles. All basic word processing features are included to allow custom formatting, cut and paste ability, changing font types and point size, inserting objects, etc. In addition to the basic word processor, the **COMPASS** Report Editor provides the ability to add plots to reports and display results from custom macros defined by the user (see sections 20, ([Data], [Plot Data File]) and 18.5(Macro Types)). The Report Editor has the ability to view, edit, save or print multiple reports at the same time. In addition to the default report format, reports can be created as ASCII (*.txt), rich text file (*.rtf), Microsoft Word 97/2000/XP (*.doc) documents, or PDF files. PDF files can be created only when Adobe Acrobat is installed on the PC running the Report Editor.

Report templates are files that resemble reports except special placeholders are used instead of actual data. Format the template to look like the desired report by directly entering text and images that are a permanent part of the report. Then drag and drop fields from the **<Available Data Fields>** panel into the template. Each field represents data that will be read from the selected Data File and added to the report. All information in the data file as well as many common calculations, **Data File Macros** and **Report Macros** are available as fields (see 18.5, Macro Types). The ability to insert data file links at any location within a report template using flexible text formatting is one of the most important features of the report editor.

Report generation always begins by selecting a report template and the data file or files to use for report generation. Any **Data File Macros** stored in the selected report template are processed. These macros may add new columns of data or manipulate existing data in the data file. The process proceedes by replacing each field in the report template with the proper data. When all fields are replaced, the report is complete (see **Figure 168**).

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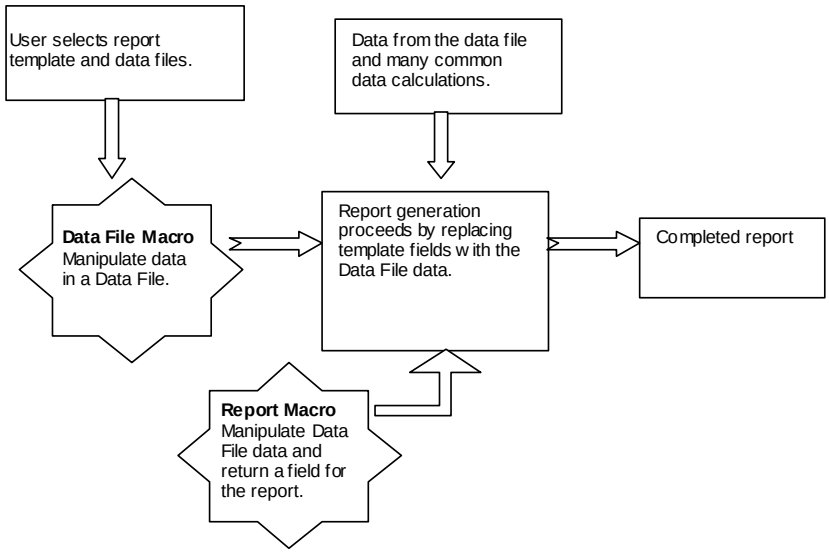
User selects report template and data files.
Data from the data file and many common data calculations.
Data File Macro
Manipulate data in a Data File.
Report generation proceeds by replacing template fields with the Data File data.
Completed report
Report Macro
Manipulate Data File data and return a field for the report.

Figure 168. Report Generation Process

The default directory locations for *.dat, *.rpt and *.tpl are flexible and specified in **[Options]**. Each file selection within the report editor defaults to one of these directories depending on the type of file required. Unless changed by the user, all report templates are stored in the ..\template sub-directory of the **COMPASS** Report Editor root directory. This current template defaults to the last accessed template.

The **COMPASS** Report Editor supports Windows drag and drop functionality. All supported files of the report editor can be dragged on to the **COMPASS** Report Editor from Windows Explorer. Depending on the type of file, the report editor will either generate a report or display the file.

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23.3 MAIN DISPLAY

The Report Editor is essentially a customized word processor and as such, functions like any other word processor. The main display contains documents and toolbars as well as a special window used to place select data fields when creating templates. Exit the Report Editor either by selecting **[File]**, **[Exit]** or the **[X]** in the upper right corner of the main form.

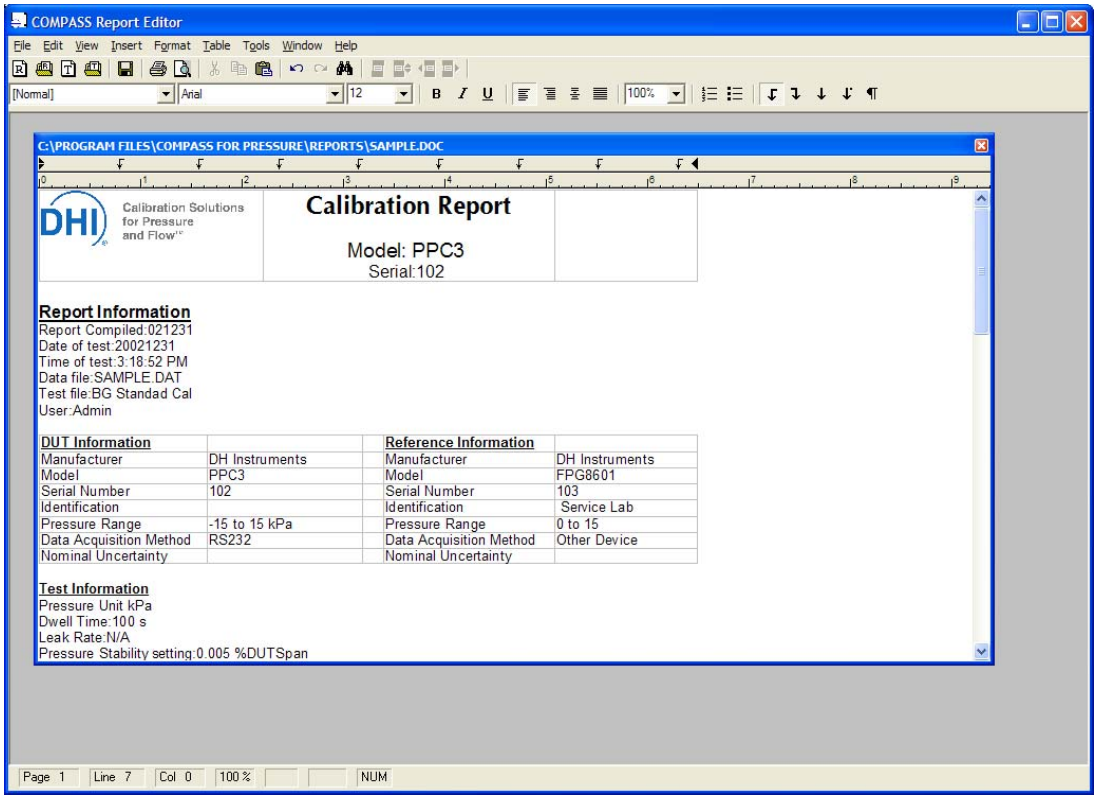

Figure 169. COMPASS Report Editor

All functionality of the Report Editor is controlled through the selection and settings made with in the main menu bar (see 23.4, Main Menu Bar). The menu is accessed either by the mouse, short-cut key combinations or by pressing **[Alt]** and the corresponding underlined character.

Four tool bars are included with the **COMPASS** Report Editor. The **<Ruler>**, **<Icon>**, **<Format>** and **<Status>** tool bars are present to assist in the development and editing of templates and reports.

A separate window will appear for each open document. Multiple report documents may be viewed simultaneously, but only one template may be edited at a time. The file name and path for the document is displayed across the top of the window. There are two types of documents in the Report Editor, reports and templates. Templates, created by the user, act as the blueprint or model on which future reports will be based. Reports are generated by merging templates with data from **COMPASS** Data Files.

23.4 MAIN MENU BAR

The **<Main Menu Bar>** of the Report Editor is divided into nine sections each dealing with a separate group of settings. Many of these settings can also be accessed by a shortcut on one of the **COMPASS** Report Editor toolbars. All of the functionality in the **COMPASS** Report Editor is controlled through the menu selections found within this toolbar.

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The **<Main Menu Bar>** may be accessed with several methods; with the use of a mouse, short-cut key strokes defined next to individual menu items, pressing **[Alt]** and the corresponding underlined letter, or by pressing **[Alt]** and then using the arrow keys to navigate the menu.

Figure 170. COMPASS Report Editor, Main Menu Bar

Items that have an equivalent toolbar shortcut, display the icon of the tool bar next to the section title.

Many menu options contain a direct toolbar shortcut. Accessing a feature with either method has the same function.

[File] The **[File]** section of the menu bar contains options that deal with files as a whole. This includes open, save and print options. This menu also contains **[Exit]** in order to close the **COMPASS** Report Editor (see 23.4.1, [File]).

[Edit] **[Edit]** governs the adding and removing of sections of text and also contains tools with which to search through the text (see 23.4.2, [Edit]).

[View] **[View]** toggles tool bars on and off, controls the appearance of documents and show or hides the tools bars (see 23.4.3, [View]).

[Insert] **[Insert]** provides a link to outside components and objects that can be added to reports and templates (see 23.4.4, [Insert]). This is primarily how images are added to templates.

[Format] **[Format]** controls the way text appears in documents (see 23.4.5, [Format]). It can change the color, add bullets, set tabs, and create advanced word processor styles.

[Table] **[Tables]** provide a very important feature. Under this menu item, tables are added or deleted from templates. Tables are required on templates in order for a report to display multiple test data points (see 23.4.6, [Table]).

[Tools] **[Tools]** stores options for the Report Editor and acts as an interface to administer the external controls that are used with the Report Editor (see 23.4.7, [Tools]).

[Windows] **[Windows]** arranges multiple documents with in the main window (see 0,

[Window]).

[Help] **[Help]** displays general information about the **COMPASS Report Editor** (see 23.4.9, [Help]).

23.4.1 [FILE]

The **[File]** section of the menu bar contains options that deal with files as a whole. This includes open, save and print options. This menu also contains **[Exit]** in order to close the **COMPASS** Report Editor.

Many of the [File] menu options enable multiple files to be selected, specifically when selecting *.dat files to generate a report or viewing *.rpt or *.doc existing reports. Use the [Shift] and arrow keys or the [Ctrl] and left mouse button to highlight the desired files within the window to make a multi-file selection. For example, when generating reports selecting several *.dat files will generate a separate report for each file selected provided that the template requires only one Data File.

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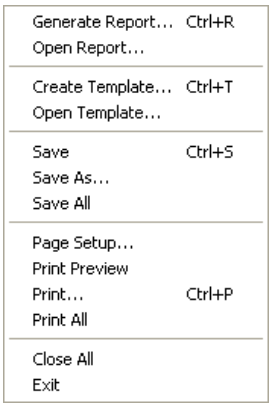

Figure 171. COMPASS Report Editor, **[File]** Menu

Table 76. COMPASS Report Editor, **[File]** Menu Fields

FEATURE	DESCRIPTION
[Generate Report…]	**[Generate Report…]** opens the **<Data File Selection>** window and prompts the user to select a template and Data Files prior to generating reports.
[Open Report…]	**[Open Report…]** views previously created reports by opening a file selection window and enabling files to the opened. The window will filter all files based on the **<Default Report Extension>** listed in **[Options]**. Regardless of the default report extension, all report types can be accessed through this window.
[Create Template…]	[**Create Template]** creates a new blank template. The template defines the information from **COMPASS** *.dat files which will be included in the report. It further defines the fixed information/image layout and the report format. A typical template includes a customized header and footer, miscellaneous text, data labels and embedded links to “data” files. The flexibility of templates and the ease with which they are created and edited allow **COMPASS** reports to be personalized to your exact requirements.
[Edit Template…]	Open an existing template for editing. Existing templates can be altered and save under a new file names to reduce the effort in creating a new template from scratch.
[Save]	**[Save]** acts on the current document in the **Report Editor**. If the current document has previously been named, the name of the file will appear across the top of the window. Choosing **[Save]** in this case saves the current contents of the window to the file name with no further prompts. Files that have not previously been saved may display Untitled or New Template in their window caption. Saving these files generates a prompt for the entry of the path and file name to be used to save this. The default file path is set in **[Options]**. If you wish to save the file in another location, do so realizing the **COMPASS** Report Editor will not default to this location unless the default path is changed.
[Save As…]	**[Save As…]** is used to save the current document under a different name, essentially making a copy of the file. The option always displays a file selection box allowing the entry of a new file name and follows the same procedure as the **Save** option when an untitled file is saved.
[Save All]	**[Save All]** will save all open documents into one selected directory.
[Page Setup…]	Sets margins, paper source, paper size, page orientation, and other layout options for the active document.
[Print Preview]	In print preview, the page is displayed as it would appear if printer on paper. You can display multiple pages of a document in a reduced size. In this view, you can see page breaks, hidden text, and watermarks, and you can make editing or formatting changes before you print the document.

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FEATURE	DESCRIPTION
[Print…]	**[Print…]** is used to print the current file to any printer setup on the PC in use. A printer setup window displays prior to printing allowing a printer to be selected and set up before printing. The **COMPASS** Report Editor prints the document exactly as it is displayed within the report editor unless a printer specific issue overrides a document feature. Since all printers do not support the same font set, it is possible for one printer to print as expected while another printer does not. If this is the case, refer to your printer's operation manual for instructions. If Adobe Acrobat is installed on the computer, printing to the Adobe Distiller will generate a .pdf file. This type of file is non-editable after generation.
[Print all]	**[Print All]** sends all open documents to a user-selected printer. Documents titled "Untitled" or "New Template" will not be printed.
[Close All]	**[Close All]** is a short cut to selecting every file currently open in the **Report Editor** then closing them individually. This is a convenient way to close several open files. If changes have occurred there is still a prompt to save the file before closing.
[Exit]	Selecting **[Exit]** closes the Report Editor.

23.4.2 [EDIT]

The **[Edit]** menu provides common word processor editing functions. Many of these functions have several possible shortcuts. The toolbar and short cut keystrokes provide direct access to many editing features. All edit functions act on the current document only.

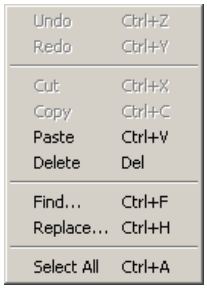

Figure 172. COMPASS Report Editor, **[Edit]** Menu

Table 77. COMPASS Report Editor, **[Edit]** Menu Fields

FEATURE	DESCRIPTION
[Undo]	**[Undo]** is provided to undo the most recent editing operation within the Report Editor. Undo support in the **COMPASS** Report Editor does not provide the ability to undo all previous steps. Only the most recent step is maintained in the undo buffer. As a result, the first time **[Undo]** is activated the last step is undone.
[Redo]	Redo is provided to reinstate items the undo has just rolled back. Redo will not recreate deleted files nor will it create new ones.
[Cut]	**[Cut]** deletes the current selection and copies it to the Windows clipboard. This information is pasted into other applications or other locations within the **COMPASS** Report Editor.
[Copy]	**[Copy]** copies the current selection to the Windows clipboard without first deleting it. The informat**ion is pasted into other applications or other locations within the COMPASS Report Editor.**
[Paste]	**[Paste]** copies the contents of the Windows clipboard to the current cursor location in the document. Pasting a selection, which includes data fields, will result in the insertion of text only and not the link to the Data File behind the data field.

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FEATURE	DESCRIPTION
[Delete]	**[Delete]** destroys the currently selected items. If items are accidentally deleted, undo may restore the information. If delete will not remove a table, try the delete command under the table menu selection.
[Find…]	Displays the **Find** option to locate specific text in a report or report template. Enter the search text in the **<Find What>** field and select the search options then press **[Find…].** The search begins at the current cursor location and continues either to the end of the document or to the beginning based on the **<Direction>**. The first occurrence of the search text is highlighted in the current document. To repeatedly search for the same text, use the shortcut key **{CTRL+F}**.
[Replace…]	Searches for and replaces the specified text and formatting.
[Select All]	**[Select All]** highlights all text in the active document. Most frequently, selecting all text is done to copy the information to later paste it in another application or open document. The selected text can also be deleted to clear an entire document of all text.

23.4.3 [VIEW]

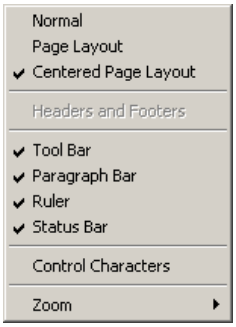

Figure 173. COMPASS Report Editor, **[View]** Menu

Table 78. COMPASS Report Editor, **[View]** Menu Fields

FEATURE	DESCRIPTION
[Normal]	**[Normal]** view is usually used for typing, editing, and formatting text. **[Normal]** view shows text formatting but simplifies the layout of the page so that you can type and edit quickly. In this view, page boundaries, headers and footers do not appear. The page number does not display in the status bar.
[Page Layout]	Work in print layout view to see how text, graphics, and other elements are positioned on the printed page. This view is useful for adjusting margins and for working with columns and drawing objects.
[Centered Page Layout]	**[Centered Page Layout]** is very similar to that of Page Layout except that this view shows the document's pages centered and displays three-dimensional borders.
[Headers and Footers]	Edits the text that appears at the top and or bottom of each page.
[Tool Bar]	Selecting this item toggles the display state of the toolbar. Refer to the previous sections for specific information on how to use these toolbar shortcuts.
[Paragraph Bar]	The paragraph tool bar contains buttons to change the format, font and size of selected text. The ruler also controls the justification controls to control text alignment.
[Ruler]	The markers on the horizontal ruler display settings for the paragraph that contains the insertion point. To change the settings for indents, margins, and column widths, drag the markers on the horizontal ruler. To set a tab stop by using the horizontal ruler, click the left mouse button where you want the tab stop.
[Status Bar]	The bar at the bottom of the document window displays information about a command or toolbar button or an operation in progress.
[Control Characters]	Show normally non-viewable characters in the documents. Examples of non viewable characters are paragraph breaks and carriage returns and line feeds.
[Zoom]	Controls how large or small the current document appears on the screen.

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23.4.4 [INSERT]

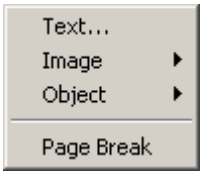

Figure 174. COMPASS Report Editor, **[Insert]** Menu

Images may be added throughout the document if desired. It is recommend that images are inserted with the [Image],<At Caret Position…> option. The ability to insert objects is included for advanced use. Objects in a document require the object interface to be registered in the Windows registry of the PC used to view the document. Objects available on one PC are not necessarily available on another. As a result, a document may display properly on one PC and not at all on another.

Table 79. COMPASS Report Editor, **[Insert]** Menu Fields

FEATURE	DESCRIPTION	
[Text…]	Display an open file dialog box for selection of a text file. When this file is chosen, the contents of this file are inserted into the document at the current carriage position.	
[Image]	Display an open file dialog box and prompts for an image to add to the document. The images are inserted in two different methods: At Caret Position, and As Fixed Object.	
	[At Caret Position…]	Object is inserted into the document as a single character. Text will not wrap around the object. Since the object is treated as a single character, it is centered much easier. The object will also maintain its position with respect to the text as the document is edited.
	[As fixed Object…]	The object is inserted into the document, but is not part of the text. It floats on top of the document and text can wrap around the object. As the document is edited, these objects may be shifted about the page and should be checked prior to completing the document.
[Object]	**[At Caret Position…]**	Object is inserted into the document as a single character. Text will not wrap around the object. Since the object is treated as a single character, it is centered much easier. The object will also maintain its position with respect to the text as the document is edited.
	[As fixed Object…]	The object is inserted into the document, but is not part of the text. It floats on top of the document and text can wrap around the object. As the document is edited, these objects may be shifted about the page and should be checked prior to completing the document.
[Page Break]	Inserts a page break at the current curser position. The page break appears as a dotted line across the documents and marks the end the current page and start a fresh page.	

23.4.5 [FORMAT]

The **[Format]** selection provides access to all the normal word processor options. Font selections, paragraph layout and bullets are all contain herein. The format toolbar contains a shortcut to almost every option available in this toolbar (see 23.6, Format Toolbar).

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23.4.6 [TABLE]

Tables are useful for either providing a fixed layout or for presenting lists of data. Tables are also used in conjunction with dynamic data fields to display test data from **COMPASS for Pressure** files (see 23.12.2, Tables). It is good practice to separate tables with at least a space.

A table is required to use data field links that represent test data acquired at each point of a test. This type of data is referred to as "dynamic data".

23.4.7 [TOOLS]

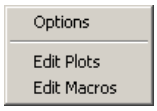

Figure 175. COMPASS Report Editor, **[Tools]** Menu

Table 80. COMPASS Report Editor, **[Tools]** Menu Fields

FEATURE	DESCRIPTION
[Options]	Displays the **Options** form (see **Error! Reference source not found.**, **Error! Reference source not found.**).
[Edit Plots]	Opens the **COMPASS** Plot Tool in order to create, edit or delete plots (see 20.4, Create/Edit Plots).
[Edit Macros]	Opens the **COMPASS** Macro Editor in order to create, edit or delete macros (see 18, [Tools], [COMPASS Macro Editor]).

23.4.8 [WINDOW]

The **[Window]** menu contains a list of the file names of all open documents in the **COMPASS** Report Editor. Any document selected in the list becomes the current top document in the editor. As an alternative to using this menu feature, clicking any open document in the display can make it the current top document.

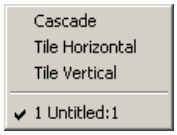

Figure 176. COMPASS Report Editor, **[Window]** Menu

23.4.9 [HELP]

Brings up the **<About>** window which provides specific version information about the **COMPASS** Report Editor.

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23.5 MAIN TOOLBAR

The Main Toolbar presents commonly accessed menu functions as icon based buttons. Use the toolbar button in place of the direct menu choice for convenience.

Figure 177. COMPASS Report Editor, Main Toolbar

Table 81. COMPASS Report Editor, Main Toolbar Fields

FEATURE	DESCRIPTION
[Generate a Report]	Close all documents and begin the process of creating a new report.
[Open a Report]	Open a report for viewing or editing.
[Create a New Template]	Close all documents and begin the process of creating a new template.
[Open a Template]	Open a template for viewing or editing.
[Save]	Save the current report or template. Document will be saved to the filename indicated across the top of the window. If the filename contains "Untitled" or "New Template" then user will be prompted to provide a filename for the document. In order to change either to file location or the file name, choose **[File]** then **[Save As…]** from the file menu.
[Print]	Prints the current report or template.
[Print Preview]	Provides an illustration of how the report or template should appear when printed on the default printer.
[Cut]	**D**eletes the current selection and copies it to the Windows clipboard. This information is pasted into other applications or other locations within the **COMPASS** Report Editor.
[Copy]	Copies the current selection to the Windows clipboard without first deleting it. The information is pasted into other applications or other locations within the **COMPASS** Report Editor.
[Paste]	Inserts the contents of the Windows clipboard to the current cursor location in the document.
[Undo]	**[Undo]** is provided to undo the most recent editing operation within the report editor. Undo support in the **COMPASS** Report Editor does not provide the ability to undo all previous steps. Only the most recent steps per open document are maintained in the undo buffer. As a result, the first time **Undo** is activated the most recent step is undone.
[Redo]	**[Redo]** is provided to reinstate items the undo has just rolled back. Redo will not recreate deleted files nor will it create new ones.
[Find]	**[Find]** provides the ability search for specific text within a report or report template. Enter the search text in the **<Find What>** field and choose the search options then press **[Find].** The search begins at the current cursor location and continues to the end of the document. The first occurrence of the search text are highlighted in the current document. To repeatedly search for the same text, use the shortcut key **{CTRL+F}**.

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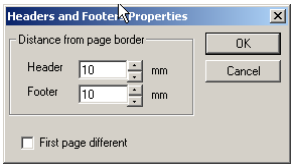
FEATURE	DESCRIPTION
[Header and Footer Properties]	In order to access the header and footer properties of a document, the report editor must be in **<Page Layout>** or **<Centered Page Layout>** viewing modes and then select **<Headers and Footers>** from the **<view>** menu. 
[Switch Between Header and Footer]	Toggles between the header and footer sections of the current page.
[Go to First Page Header or Footer]	If **<First page different>** is selected in **[Header and Footer Properties]** then selecting this icon move the cursor to the header of the first page.
[Go to Default Header or Footer]	If **<First page different>** is selected in **[Header and Footer Properties]** then selecting this icon move the cursor to the header of the second and subsequent pages.

23.6 FORMAT TOOLBAR

The Format Toolbar provides access to standard font and paragraph formatting options. The purpose and use of each option on this toolbar are summarized in **Table 82**. Each selection on the Format Toolbar is used to affect a range of text by highlighting the desired text then making a selection. When a text range is not selected, any Format Toolbar selection will effect all text entered at the current insertion point only. This toolbar also displays the formatting in place at the current insertion point. Using the arrow keys to move within the text of an open document refreshes this toolbar with the current text formatting at the cursor insertion point.

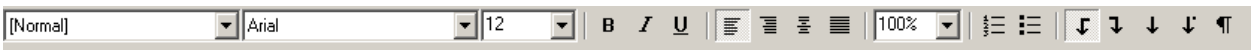


Figure 178. COMPASS Report Editor, Format Toolbar

Table 82. COMPASS Report Editor, Format Toolbar Fields

FEATURE	DESCRIPTION
[Format]	Specifies whether character and paragraph formatting properties apply to the complete document or limited to a selection.
[Font Selection]	Displays and changes the current font. A complete list of all fonts supported by the PC displays in the font selection box.
[Font Size]	Displays and changes the current font size. Enter the numerical value of the desired font size and press **[ENTER]**. Each value entered or present in the document is added to the list of available font sizes and are selected using **[↓]**.
[Font Bold]	Displays and changes the current font bold setting. **[CTRL]+B** is a shortcut to this toolbar item. **This font is in bold.**
[Font Italic]	Displays and changes the current font italic setting. **[CTRL]+I** is a shortcut to this toolbar item. *This font is in italics.*

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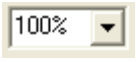
FEATURE	DESCRIPTION
[Font Underscore]	Displays and changes the current font underscore setting. **[CTRL]+U** is a shortcut to this toolbar item. This font uses an underscore.
[Left Justify]	Displays and changes the paragraph justification to left. Left justification forces all text to begin at the current left indentation point. Only one style of justification is used per paragraph.
[Right Justify]	Displays and changes the paragraph justification to right. When active, text is aligned to the right indentation point of the document. Most commonly this is the right margin.
[Center]	Displays and changes the paragraph justification to center. When active, text is centered between the left and right indentation points.
[Full Justify]	Displays and changes the paragraph justification to the left and right margin. When active, text is center with and even margin along the left and right margins.
[Zoom] 	Increase or decrease the appearance of the document in the Report Editor.
[Number Bullets]	Add or remove numbered outlines from a paragraph.
[Bullets]	Add or remove bullets to a paragraph.
[Tab Left]	Adds text beginning at the tab and then moves text to the left as more characters are typed.
[Tab Right]	Adds text beginning at the tab and then moves text to the right as more characters are typed.
[Tab Centered]	Adds text beginning at the tab and then centers text about the tab as additional characters are typed.
[Tab Decimal]	Adds text beginning at the tab and then centers text about the decimal point as additional characters are typed.
[Show Formatting]	Toggles the ability to view formatting characters in the document.

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23.7 RULER

The ruler gives a visual indication, in inches, of the document layout. At all times the left most position of the ruler corresponds to the left margin setting of the document. Changes in the margin settings will not reflect on the ruler. The **COMPASS** Report Editor uses the ruler mainly to support tab positioning and paragraph indentation.

Tabs and indent values are adjusted by using the mouse to click and drag the tool to the desired location. Where the mouse button is released determines the new location of the indent or tab.

Figure 179. COMPASS Report Editor, Ruler

Table 83. COMPASS Report Editor, Ruler Options

FEATURE	DESCRIPTION
Left Indent	Sets or displays the left indentation point of the first line of a paragraph. The ruler location of this indent always displays as the number of inches from the left margin.
Left Hanging Indent	Sets or displays the left hanging indent of subsequent lines in a paragraph. Using the mouse, click the left hanging indent image and drag it to the desired location then release the mouse button to drop it. This parameter has no effect on the first line of a paragraph and are greater than or less than the left indent.
Right Indent	Sets or displays the right indentation point of a paragraph. Unlike the left indent properties, the right indent affects the entire paragraph. The ruler location of this indent always displays as the number of inches from the left margin.
Tab	Sets or displays the locations of all tabs that effect the current insertion point. To add a tab, click the ruler where you want the tab to be located, an arrow appears indicating the new tab location. Adjust tab locations by using a mouse drag and drop operation. A maximum of 15 tabs are used to affect a single range of text.

23.8 STATUS BAR

Displays status messages about the operations performed in the Report Editor. These messages clear after thirty seconds or when a new message is displayed.

23.9 OPTIONS

The **[Tools]**,**[Options]** dialog provides access to features that manage preferences specific to the **COMPASS** Report Editor. The options specify default locations, and determine how the Report Editor behaves under different report generation conditions. Change the options by selecting the appropriate tab and entering (or selecting) the desired option values. Press **[Save]** to save the changes or **[Exit]** to close the Options form without saving.

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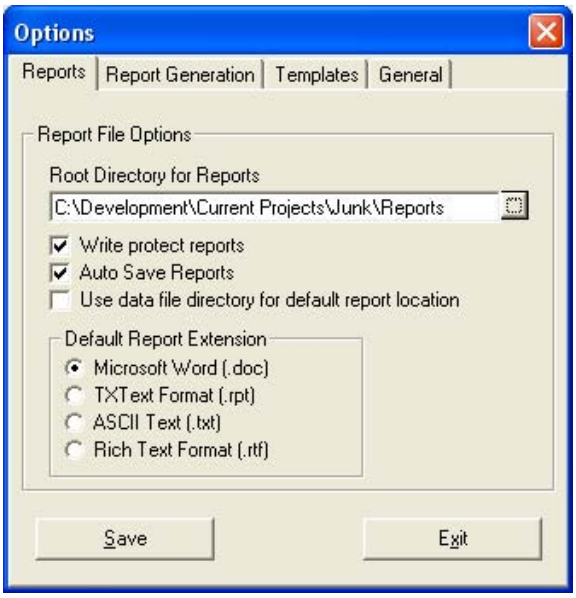

Figure 180. COMPASS Report Editor Options

23.9.1 [REPORTS] TAB

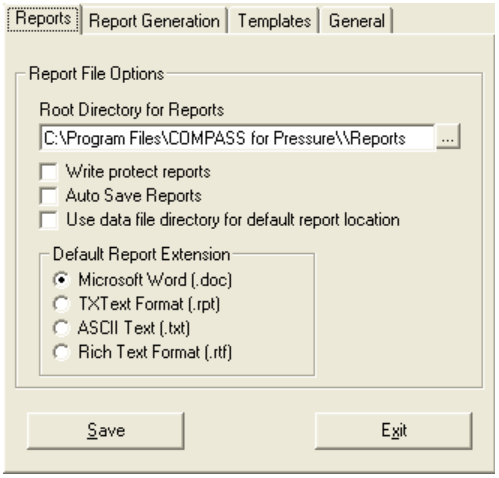

Figure 181. COMPASS Report Editor Options, **[Reports]** Tab

Table 84. COMPASS Report Editor Options, Reports Options

FEATURE	DESCRIPTION
Root Directory for Reports	Provide the default path for reports. This is the location where users are promoted to save their report or where auto saved reports are saved. If "Use Data File directory for default report location" is checked, then that supersedes this selection and files are auto saved to the data's path directory.
Write Protect Reports	After reports are saved, set the read-only property on the file. As soon as reports are generated and saved, the report file properties are change to allow read only access. This setting can only be altered by editing the properties of the file directly through the Windows operating system.
Auto Save Reports	Reports generated automatically have the same file name as the first **COMPASS** *.dat file used as a data source, but with the default report extension. Auto-saved reports are saved to the root directory for reports. If a newly created report has the same name as an existing report, the user is prompted to change the file name of the new report.
Use Data File	Use the path of the first Data File as the default path for the report. Checking this box

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FEATURE	DESCRIPTION
directory as default report location.	supersedes the path in the Root directory for reports.
Default Report Extension	Determines what format the reports are saved in. The **COMPASS** Report Editor allows a report to be created and saved in a number of formats. Each format has pro's and cons which are dependant on the final use of the report. The report editor can convert files between formats, but not all formats support all functionality. The operator risks the loss of information when converting between file formats. ⚠ If the Report Editor is used to convert one report type to another, some content may be lost. The amount and type of information lost is dependant on the starting and ending file types. For example, ASCII Text files cannot contains graphs or specialized fonts. **Microsoft Word (*.doc)** — Best used for sharing reports with other users that may not have access to the **COMPASS** Report Editor. Microsoft Word format maintains most functionality with the original report, but formatting may appear different on individual computers. The Microsoft Word format is consistent with Microsoft Word releases 97 through 2002(XP). Older versions may not be able to view these reports. **Report Editor Format (*.rpt)** — This format is the most compatible with the **COMPASS** Report Editor. Reports saved in this format can only be opened with the **COMPASS** Report Editor but are converted to all other formats easily. **Rich Text Format (*.rtf)** — Rich Text Format is more restrictive of content than either the *.rpt or *.doc formats. This format will not retain plots, images or other inserted objects but will preserve text formatting. **ASCII Text (*.txt)** — Most restrictive of all file formats. The ASCII Text format will not retain plots, images or other inserted objects not will it maintain text formatting. This format has the smallest file size that other formats and is the most portable to other programs.

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23.9.2 [REPORT GENERATION]

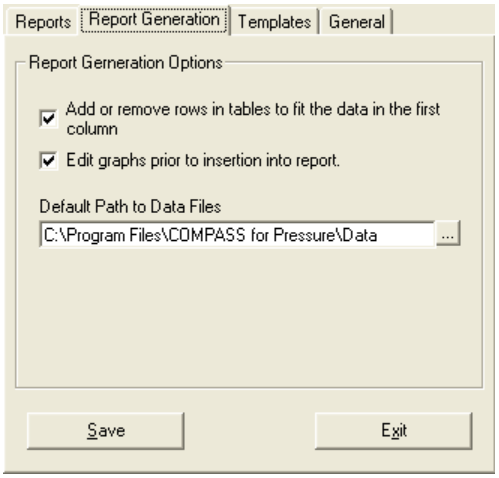

Figure 182. COMPASS Report Editor Options, **[Report Generation]** Tab

Table 85. COMPASS Report Editor Options, Report Generation Options

FEATURE	DESCRIPTION
Add or Remove Rows	This selection enables the Report Editor to add or remove rows in a table as required to ensure that there is adequate room for all data as well as to remove any excess rows when generating a report. The determination whether to add or remove rows is based on the requirements of the first column of data in a table. When dynamic data (data logged at each point in a test) is expanded inside a table during report creation, there may exist a surplus or shortage of rows. If this is the case and this option is enabled, the **Report Editor** will expand or contract the number of rows in the table as required. Rows are not removed unless they are blank.
Edit Graphs Prior to Insertion	When enabled, the current plot is displayed during report generation. While viewing the displayed plot, alter the plot type, scale, colors or any other special formatting prior to inserting the plot. Formatting may include, turning on or off specific data points or changing plot type or colors. When all changes are complete press the **[Inser Plot]** button on the plot toolbar to add to plot to the report. After the plot is added to the report, no further changes can be made. Refer to section 20, [Data], [Plot Data File] for details on how to change plots in **COMPASS**. Create a custom plot opposed to systematically using this option. This feature is provided for special cases in which a custom plot is not merited.
Default Path to Data Files	This is merely the initial location the Report Editor will browse when attempting to locate Data Files. The last used Data File path is used by default when selecting a data file. This field in no way restricts access directories when selecting files.

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23.9.3 [TEMPLATES] TAB

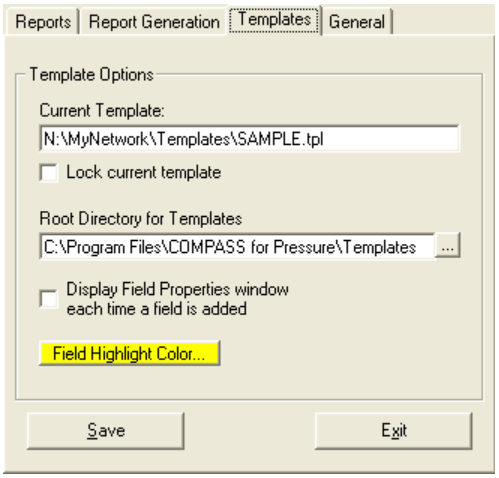

Figure 183. COMPASS Report Editor Options, **[Templates]** Tab

Table 86. COMPASS Report Editor Options, Templates Options

FEATURE	DESCRIPTION
Current Template	Indicates the current template that will be used to create reports. This is also the default template that is used if no other template is identified prior to creating a report. Double click this box to select a new default template. The default template also changes when a new template is selected in the **<Selection>** form or when a report is generated.
Lock Current Template	Prevents the current template from being changed. This will override all requests to update template and ignore templates included as arguments.
Root Directory for Templates	Displays the default directory where the user is prompted to save templates.
Display Field Properties window each time a field is added.	Check this option to automatically prompt to modify each field's properties as fields are added to a template. Field properties are accessed later by left clicking above the field to be edited and choosing properties from the pop-up menu.
Field Highlight Color	Press this button to change the color used to highlight fields in a report template. The current highlight color is indicated by the color of the button. Changes to the highlight color only affect future fields as they are added. Fields that have already been placed will not have their color changed.

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23.9.4 [GENERAL] TAB

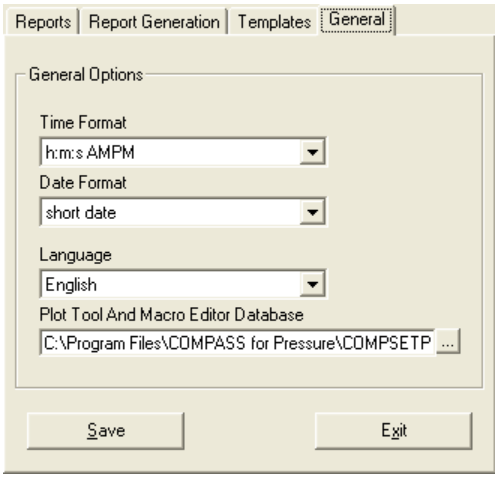

Figure 184. COMPASS Report Editor Options, **[General]** Tab

Table 87. COMPASS Report Editor, Ruler Options

FEATURE	DESCRIPTION
Time Format	Choose the format with which the **Report Editor** will use to display time information in the report. The options are described in the table below.

FORMAT	RESULT
None	10/31/2002 11:59:02 PM
Short Time	23:59
H:M:S AMPM	11:59:2 PM
H:M:S	23:59:2
HH:MM:SS	23:59:02
Long Time	11:59:02 PM

Date Format	Choose the format that the Report Editor will use to display date information in the report. The options are described in the table below.

FORMAT	RESULT
None	10/31/2002 11:59:02 PM
Short Date	10/31/2002
yyyymmdd	20021031
yymmdd	021031
mmm d yy	Oct 31 02
mmmm d yyyy	October 31 2002
Long Date	Thursday, October 31, 2002

Language	Enables the user to choose between the available languages. Currently English is the only available language. Future plans incorporate a strategy to include user-defined languages and terminology as well as a method to upgrade language support as new languages become available.
Plot Tool and Macro Editor Database	This path should point to the database that is common to both the **COMPASS** Plot Tool and the **COMPASS** Macro Editor. Without a valid path, plotting and macro functionality will not be available. By default, the file is the same as the value selected in the **COMPASS** main program (see 24.2, [Database], [Setup]).

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23.10 FIELD PROPERTIES

Field Properties govern the way the field is replaced with data during report generation. Click any field in a report template to view the field properties. Options are provided to automatically display field properties after each field is added to a report template (see 23.9.3, [Templates] Tab).

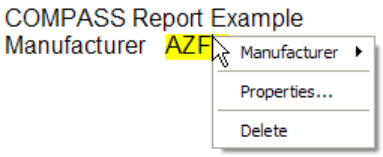

Figure 185. COMPASS Report Editor Field Properties

Table 88. COMPASS Report Editor Field Properties

FEATURE	DESCRIPTION
Name	The name of the field is displayed at the top of the pop-up menu and if highlighted will bring up another window displaying the field hierarchy. The field hierarchy is a simple explanation of where the field was chosen from in the list. This may assist the user in determining what data will replace the inserted field.
ID	The **<ID>** is included as an aid in programming and trouble shooting macros created for use with the Report Editor. The **<ID>** value is linked to a specific piece of data stored in the **Test Data Class** (see **Test Data Class**, 28.3)
Properties	Displays the **Field Properties** form (see 23.10.1Field Properties).
Delete	Left click this to remove the field from the template. This is the most secure method with which to remove fields from templates. If a field is simply typed over or deleted using the **[Delete]** or **[Backspace]** key, then there exists the possibility that it was not completely removed from the template. This could affect reports created with this template.

23.10.1 FIELD PROPERTIES FORM

The field properties window displays by selecting the **[Properties]** option on the field dialog This window displays differently based on the selected field type. The complete information contained below is not available for all fields. The options on each of the tabs are described in the following sections. Edit the field properties as desired then press the **[Update]** button to apply the changes to the currently selected field. The **[Undo]** feature cannot undo changes made to field properties.

23.10.2 [DATA FORMAT]

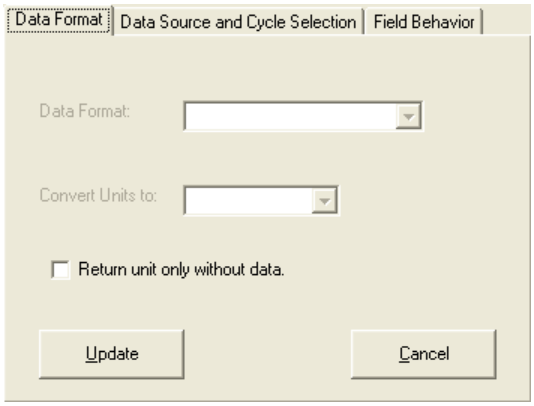

Figure 186. COMPASS Report Editor Field Properties, **[Data Format]** Tab

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Table 89. COMPASS Report Editor Field Properties, **[Data Format]** Tab

FEATURE	DESCRIPTION
Data Format	Enables users to select individual formats for each numeric data field placed in a template. This individual format will have precedence over the format set by **COMPASS for Pressure**. Any custom format may be entered, but in-correct formats may result in data loss.
Convert Units to	Currently not enabled. Future use will enable users to convert pressure and temperature data items to other units supported by the Unit Converter.
Return unit only without data	If only the unit associated with the data item is required, enabling this box removes the numeric portion of the data. Use this feature in tables of data when the unit alone is desired.

23.10.3 [DATA SOURCE AND CYCLE SELECTION]

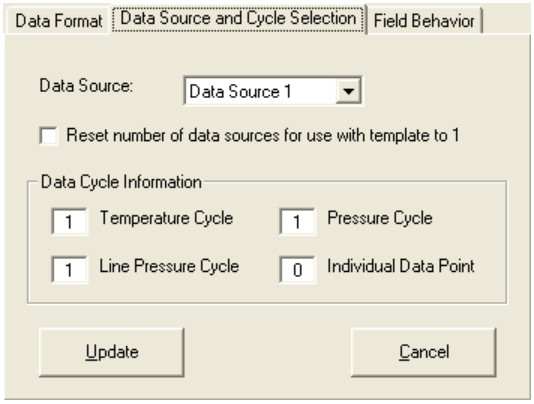

Figure 187. COMPASS Report Editor Field Properties, **[Data Source…]** Tab

Table 90. COMPASS Report Editor Field Properties, **[Data Source…]** Tab

FEATURE	DESCRIPTION
Data Source	Use this field to generate a report that includes data from one or more Data Files. Up to five files can be selected. The source file for the data is selected here. The Data File number corresponds to the order that individual Data Files are selected in the **<Data File Selector>** (see 23.11.1, Selecting Template and Data).
Reset number of data sources	"Reset number of data sources for use with template to 1" will do just that. Selecting this option resets the number of required data sources to one. All data from other data sources will no be ignore if required by other fields. This is included as a method to correct the number of data sources required in a template after fields (with a data source greater than one) have been deleted. This helps to ensure that templates behave correctly when creating reports.
Data Cycle Information	Select cycle and point values as required to display a single test point in a report. To return all information for a particular cycle or point, enter a "0" in the field that you wish to report data on. Enter a nonzero value in the other fields. To report all test points for a particular temperature, line pressure, and pressure cycle enter: **<Temperature Cycle>** = 1; **<Pressure Cycle>** = 1; **<Line Pressure Cycle>** = 1; **<Individual Data Point>** = 0. To report all points for the 4th pressure cycle change the **<Pressure Cycle>** entry to "4". To report only the 3rd test point, change the **<Individual Data Point>** value to "3". Enter a "1" in cycle fields even when the cycle was not executed during the test. For example, always enter 1 for **<Temperature Cycle>** when temperature points were not defined in the Test Definition (see 8.6, Test Point Sequence). The default selections report data on all test points in the first cycle.

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23.10.4 [FIELD BEHAVIOR]

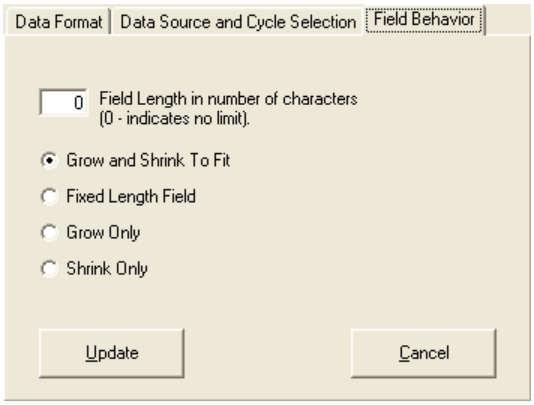

Figure 188. COMPASS Report Editor Field Properties, **[Data Source…]** Tab

Table 91. COMPASS Report Editor Field Properties, **[Data Source…]** Tab

FEATURE	DESCRIPTION
Field Length in Number of characters	Defines the length of the data field on the template. Depending on selections below, this field may increase or decrease in size to fit the data when it is replaced. Use this feature to limit (or force) the size of a field to maintain symmetry in a report.
Grow and shrink to fit	Data field will expand or contract to fit the replacement data size. The number of characters selected is imposed on the field. Spaces are added to the field when the field's size is too small, and the field is truncated when the size is too large.
Fixed length	Field will not change with data size and replacement data will either be padded with spaces or truncated to fit field size.
Grow Only	Field will only expand to fit data. Data that is not large enough to fill the field will be padded with spaces.
Shrink Only	Field will only contract to fit the data. If data is too long to fit the field, then it will be truncated.

23.11 REPORT CREATION PROCESS

There are several ways to create reports from with **COMPASS** test data. The **COMPASS** Report Editor supports report generation from **COMPASS for Pressure**, drag and drop Data Files from Windows Explorer and creation within the Report Editor itself.

All report creation begins with the template selection. If no template is selected, the current template or default template is used (see 23.9.3, [Templates] Tab). Next, the data source for reporting must be identified. This is accomplished by selecting individual Data Files or database records from the Data Selector window. After all sources are identified, the **COMPASS** Report Editor will merge the data with the template by replacing the highlighted fields with corresponding data source information. All other formatting in the template is unmodified. The final report is then displayed in the Report Editor. This report can then be printed, saved or manipulated in any way desired.

23.11.1 SELECTING TEMPLATE AND DATA

The most common method used to create a report is to select **[Create Report…]** from the **[File]** menu or the comparable icon from the toolbar. Both methods open the **<Data Selector>** window where the report template and data sources. Data stored in Data Files and the **COMPASS** Test Data Database can be used for reporting. Press the **[Select Additional Data Files]** button to use Data Files as sources; Press the **[Select Additional Data From Database]** to use database data as a source. Database data is selected using the **COMPASS** Data Viewer (see 21.2, COMPASS Data Viewer).

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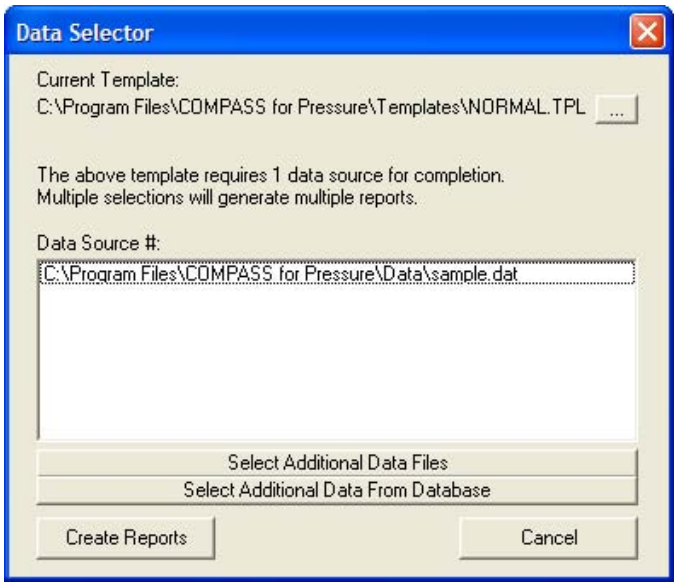

Figure 189. Data Selector

While there is no limit to the number of data sources that may be chosen, a maximum of five may be used for a single template. Manipulate the fields property of Test Data template fields to report multiple data sources on a single report (see 23.10.3, [Data Source and Cycle Selection]). If the number of data sources chosen exceeds the data source requirement for a template, the extra data sources are discarded. For example, if 4 data sources are selected and used with a template that supports 3 data sources, the 4th data source is not reported in any way. On the other hand, if a template requires more sources than selected, data fields requiring the missing data are removed and not replaced.

If multiple Data Files where chosen and the template requires only a single Data File, multiple reports are generated all based on the same template.

If a data source consists of multiple cycles, a separate report will be generated for each cycle.

The order from top to bottom in which data sources appear in the **<Data Source>** list corresponds to the numeric id of each data source. The first or top source is considered to be Data Source #1.

To edit the order of files in the list, the user should highlight the file they wish to move and then use [Shift] + [↑] or [Shift] + [↓] to adjust the position of the file.

After source selection is complete, press **[Create Reports]** to initiate the loading of files and creation of reports. The Report Editor will merge the source data with the template to create a report.

23.11.2 DRAG AND DROP CREATION

The **COMPASS** Report Editor supports the ability create reports with the drag and drop method. Data Files are dragged over the main window of the Report Editor and dropped. The Report Editor will use the default template to create reports based on this data. Multiple

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reports may be produced depending on the number of Data Files and the data requirement of the default template. Data Files that are dropped must be valid **COMPASS** Test Data Files and have a ".dat" extension.

23.11.3 SAVING REPORTS

Depending on options selections, the Report Editor will auto save and write protect reports as soon as they are generated (see 23.9.1, [Reports] Tab). These options are controlled from the **<Options>** window and must be set prior to creating reports. These options also govern the default format and location of saved reports. These selections are merely defaults. There are no restrictions imposed on the location and type of files saved manually by using the **[Save]** (or **[Save As]**) option.

Reports are saved in one of four separate formats. The formats are differentiated by file extension. Each format has unique benefits. By default, the *.doc format is recommended.

23.11.4 DISPLAY / VIEW REPORTS

Old reports are recalled and viewed in the Report Editor by using the **[File]**, **[Open Report]** menu. Reports created in the Report Editor Report Format (*.rpt) must be viewed with the report editor. All other report types may be viewed with other word processors.

23.12 TEMPLATE CREATION PROCESS

A template is required to create a report. A template acts as the foundation of a report. While a template may include text, images and other objects, the main feature of the template is the data field. During report creation, data fields are replaced by actual data from the selected data source(s) (see 23.11.1, Selecting Template and Data).

To create a report template follow the procedure outlined below.

- Press the **[Create Template]** toolbar option. All open files must be closed or saved prior to editing a new template. A blank template will display on the right and the **<Available Data Fields>** panel will display on the left.

Several default templates are installed with COMPASS. These templates provide simple common reports. Use these templates as examples to create custom templates. Start by opening an existing template. Edit the template as desired, then save the template with a different name.

- Format the template to look like the desired end report: add graphics, header/footer information, tables, labels, various fonts etc. In general, the final report looks just like the template.

To separate tables with a carriage return, line feed and space.

- Add fields from the **<Available Data Fields>** panel to the template at locations in which the actual data is desired. To add data fields to the template either drag and drop them from the **<Available Data Fields>** panel onto the template or double click the data field to add it to the template at the current cursor position. If the option to edit field properties is enabled (see 23.9.3, [Templates] Tab), the Field Properties form will display after a field is inserted (see 23.10, Field Properties). If necessary, manually display the field properties by clicking the field on the report template. The field properties help control how the field is used during report generation.

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- Data stored in each test point (reference pressure, DUT Pressure, etc.) must be included in a table to automatically display all points of the selected type. These fields are preceded by "#" when displayed on the report template. If the field is not included in a table, only 1 point is logged in the report. When the field is included in a table, all points of the type specified by the field's properties are logged. By default, table rows are added and deleted to accommodate all data points reported (see 23.9.2, [Report Generation]).

Add tables to display fields located in the <Data File> section of the <Available Data Fields> panel (see 23.12.2, Tables). This is data logged at each point in a test. The table is visible in the Report Editor only. The table is not visible on printed reports.

- Add fields from the **<Available Data Fields>**.

23.12.1 AVAILABLE DATA FIELDS

The <Available Data Fields> panel displays on the left side of the **COMPASS** Report Editor when editing a template. This display defines all data directly available for reporting. Not every field in this panel is guaranteed to be in any selected data source. Options in the **COMPASS** main program control the actual data stored in a Data File (see 14.9, [Data In File] Tab). In the case where a data field is included in a template, but the corresponding data is not present in the Data File, the data field is simply deleted.

The display of the **<Available Data Fields>** panel is segregated in to 4 main sections. Within each section are other layers of segregation. Locate the desired data by first choosing the appropriate top level topic, then search the hierarchy for the desired field. **Table 92** describes the 4 main sections of the **<Available Data Fields>** panel.

Table 92. COMPASS Report Editor Available Data Fields

DATA FIELD TYPE	DESCRIPTION
General Information	General data fields are replaced one for one by data from the selected data sources. These fields mostly consist of device and test information. In most cases, units cannot be appended to these fields. Only device information available in the data file can be reported (see 14.10, [Data Header] Tab).
Test Data	Test Data Fields represent actual test data recorded during the test and calculated values commonly used for reporting. The items are categorized by data type. Most, but not all fields in the Test Data section are "dynamic" data fields. These are fields that have a different value for each point in a test. Dynamic data fields should be placed in a table (see 23.12.2, Tables). When placed in a table and the **<Individual Point>** is set to the default value of 0, all points for that particular cycle are inserted into the table beginning at the current cell and continuing down the column. Dynamic data fields that are not included in a table report a single value regardless of the number of points taken during a test.
Plot	All plots defined by the **COMPASS** Plot Tool can be used for reporting (see 20, [Data], [Plot Data File]). When a plot is inserted, the plot properties can be altered to include tolerance bars and limits. Custom plots can also be edited at this time.

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DATA FIELD TYPE	DESCRIPTION	
Macro	There are two types of macros used in the Report Editor, Template and Field Macros. Both types of macros are created and maintained with the **COMPASS** Macro Editor (see 18, [Tools], [COMPASS Macro Editor]).	
	Template Macro	All Template macros are executed 1 time when a template is first used to generate a report (see 18.5.1 Data File Macros). Any return value from these macros is ignored. The macros are typically used to update macro and user defined data in the Test Data Class (see 28.2, Test Data Class). If this is the case, make sure the fields that are updated are also included in the report template. Up to 5 template macros can be used for any 1 template.
	Field Macro	Field macros are provided to create custom calculations with a single return value (see 18.5.7, Report Macros). The return value of the macro is used as is. Therefore, any desired formatting must be handled by the selected macro. Any number of field macros can be added to a report template. When the report is generated, the result of the macros will display on the final report.

23.12.2 TABLES

Tables are required in a template in order to display multiple points of data from a file. Data fields should be dragged over and placed in cells of the table. As a report is generated, cells are filled vertically from top to bottom, beginning with the inserted field. If an adequate number of rows are not found, the report editor may add additional rows in order to show all data (see 23.10.4, [Field Behavior]). If this option is enabled, it will add additional rows based solely on the requirements of the first column.

To add a table, select the **[Table]**, **[Insert]** menu choice while editing a report template. An option to specify the number of rows and columns is provided. A table is added at the last cursor position prior to selecting the **[Table]** menu option. Then drag and drop the desired fields into the table in different columns (see **Figure 190**).

Each data field can display all points for a test pressure cycle. To display other pressure cycles or compare test or line pressure cycles, the field's properties must be edited. This is done after each field is added to the template (see 23.10.3, [Data Source and Cycle Selection]).

Information added after a text field in a table, could be over written if the number of points exceed the blank rows between cells.

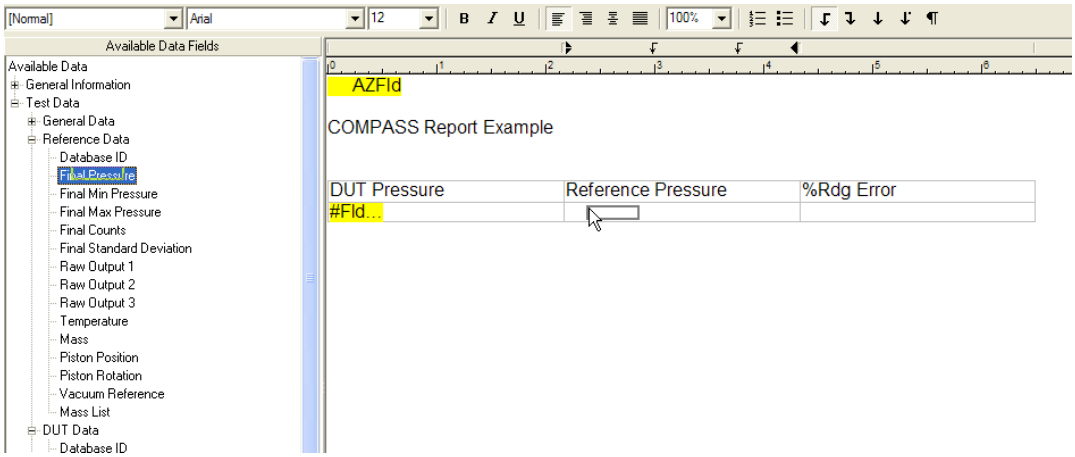

Figure 190. Adding Dynamic Data to a Table

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NOTES

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24. [DATABASE], [SETUP]

24.1 OVERVIEW

The database menu choice contains features directly related to the **COMPASS** configuration database. **COMPASS** uses a Microsoft Access Database to store device setup and configuration information. This database can be shared simultaneously by up to 10 users when a **COMPASS** site license is purchased and the database is placed on a shared network drive. The following sections describe the features available in this menu choice.

24.2 [DATABASE], [SETUP]

Use this menu choice to change the configuration database file, check the number of active database connections and to specify that the database is used in a shared environment.

Click the **<COMPASS Configuration Database>** field to display a file selection dialog that can be used to select a new database. This task is necessary to use a networked database or to simply use a backup copy of a local database.

Check the **<Database is Networked with other COMPASS stations>** option when more than one station will use the **COMPASS** database.

The Station Identification field should contain a string that uniquely identifies the current station. By default, the string in this field is the Computer Name read from the Windows registry.

Changing the Station Identification will hide local tests created using the old Station Identification. In most cases, it is not necessary to change the Station Identification.

Press the **[Check Connections]** button to find out how many users are actively using the **COMPASS** database**.** This may be necessary in a networked environment when the number of users exceeds licensed user limit. For site licenses, this is 10. For single user licenses, it is only 1.

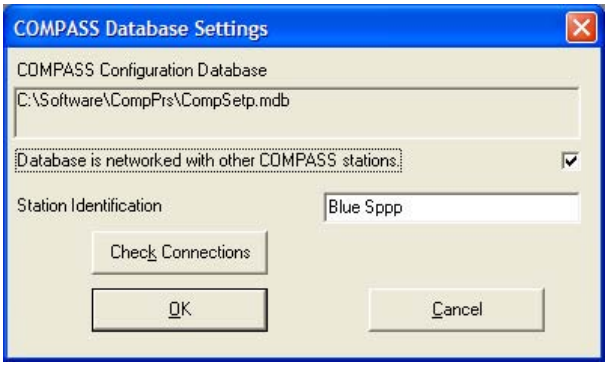

Figure 191. COMPASS Database Settings

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24.3 [DATABASE], [USERS]

The **<COMPASS Users>** dialog defines the available **COMPASS** users and their associated rights. Use the **[Database]**,**[Users]** menu to access this feature. The user rights determine what features of **COMPASS** are not accessible for a user. In most cases, restricted access to a feature means that changes cannot be saved, however all aspects of the feature can be viewed. The objective is to preserve the integrity of **COMPASS** setups and data.

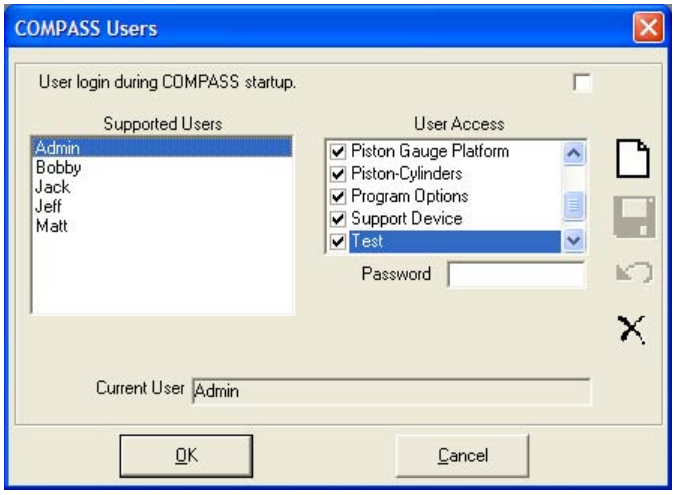

Figure 192. <COMPASS Users>

To maintain users rights, the access level of the current user must include access to the **[Database]**, **<Users>** feature. If this is not the case use the **[Database]**, **[Change Current User]** option. Use the editor toolbar to add and remove users from the **<Supported Users>** list. When any field of the dialog changes or a new user is added, the form changes to edit mode. In edit mode, make the necessary selections and entries in the **<User Access>** list, **<Password>** field, and **<User Name>** fields. Use the **[Undo]** button to abandon edits to a user. Press the **[Save]** button to save changes to the selected user.

The Admin user cannot be removed or renamed. Edit the Password if desired.

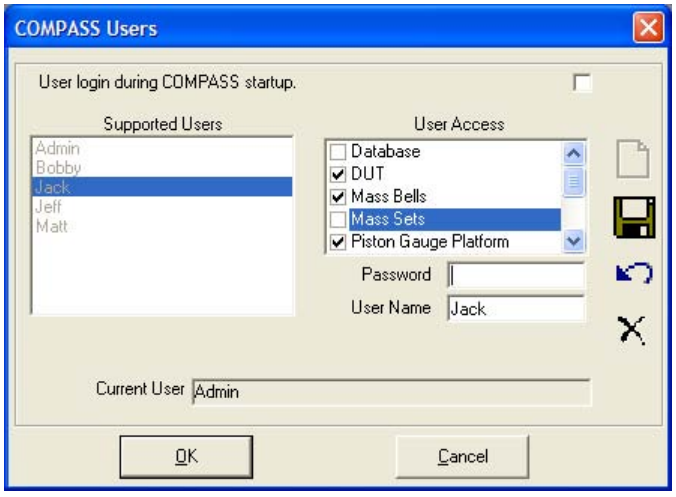

Figure 193. <COMPASS Users> in Edit Mode

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The table below lists the user rights associated with different selections in the **<User Access>** field. To maintain users rights, the access level of the current user must include **<Users>** access. If this is not the case use the **[Database]**, **[Change Current User]** option. Use the **[Add]** and **[Remove]** buttons to add and remove users.

Table 93. COMPASS Users Selections and Associated Rights

FEATURE	DESCRIPTION
User login during COMPASS startup (checkbox)	Check this option to require a valid login during **COMPASS** startup. When this feature is not checked, the last user and associated rights are automatically enforced by **COMPASS**.
Supported Users (drop down list box selection)	List of all supported users. Click a name in the list to view the corresponding **<User Access>** limits and **<Password>**.
User Access (list of checkboxes)	Displays the list of rights associated with the current user selected in the **<Supported Users>** list. Options that are checked give the user full access. Options that are not checked are restricted to the user.
Password (conditional entry)	Displays the password for the selected Supported User.

24.4 [DATABASE], [CHANGE CURRENT USER]

The **<User Login>** dialog is used to allow users to log into **COMPASS** with specific rights. The rights associated with a particular user are defined using the **COMPASS** Users setup. User login can occur during **COMPASS** startup or by direct user selection in the **[Database]**, **[Change Current User]** option.

Select or enter a supported **<User Name>** and enter the **<Password>**. If the information is valid, program control returns to the **COMPASS** main program with the rights assigned to the user.

To prevent or force the User Login dialog to display during COMPASS start up, use [Database],[Users],<User login during COMPASS startup>.

Figure 194. <User Login>

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24.5 [DATABASE][COMPASS DATABASE MAINTENENCE TOOL]

The **COMPASS Database Maintenance Tool** is provided to copy information from one **COMPASS** database to another. Any **COMPASS** maintained setup information can be transferred including tests, support devices, DUTs, macros, examples and users. Additionally, tools are provided to clean up the active database and remove unwanted setups.

Select the type of information to transfer in the **<Data to View>** list. The information available for the selected view type automatically displays in each database frame. Choose the individual setups to copy in the **<Merge Database>** or the **<Active COMPASS Setup Database>** frames, then press the **[Up]** or **[Down]** arrow to copy the data from one database to the other. Use the **[Clear]** and **[All]** buttons to quickly de-select or to select all options in a frame.

All dependencies of setups copied from one database to another are copied. The one exception is for macro dependencies within a macro. That is, a function within a macro is not automatically copied when the main macro function is copied to another database.

The database file **Default.mdb** is installed with **COMPASS** and can be updated from the DHI website. This file contains default setup information and many example setups. This file is typically used as the **<Merge Database>**. It is also useful to use information from this database when a default setup in the active database becomes corrupt or is deleted.

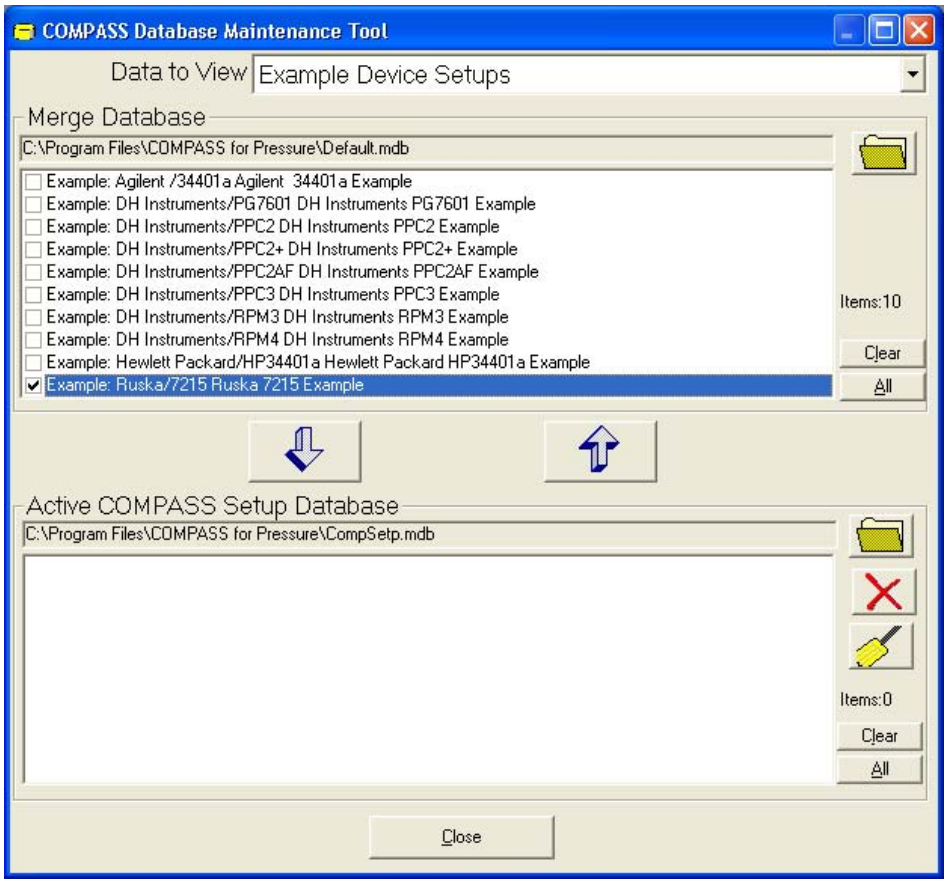
COMPASS Database Maintenance Tool
Data to View
Example Device Setups
Merge Database
C:\Program Files\COMPASS for Pressure\Default.mdb
Example: Agilent /34401a Agilent 34401a Example
Example: DH Instruments/PG7601 DH Instruments PG7601 Example
Example: DH Instruments/PPC2 DH Instruments PPC2 Example
Example: DH Instruments/PPC2+ DH Instruments PPC2+ Example
Example: DH Instruments/PPC2AF DH Instruments PPC2AF Example
Example: DH Instruments/PPC3 DH Instruments PPC3 Example
Example: DH Instruments/RPM3 DH Instruments RPM3 Example
Example: DH Instruments/RPM4 DH Instruments RPM4 Example
Example: Hewlett Packard/HP34401a Hewlett Packard HP34401a Example
Example: Ruska/7215 Ruska 7215 Example
Items:10
Clear
All
Active COMPASS Setup Database
C:\Program Files\COMPASS for Pressure\CompSetp.mdb
Items:0
Clear
All
Close

Figure 195. COMPASS Database Maintenance Tool

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Table 94. COMPASS Database Maintenance Tool

FEATURE	DESCRIPTION
Data to View (drip down list box)	Select the type of information to copy. Individual setup types are selected from this list. Optionally, all setup information can be updated by selecting the **<***All Database Information***>** option.
Merge Database (display label)	The database that contains the desired setup information. Use the **[Open File]** button to select a different file. The merge buttons add data to or copy data from this database.
Active COMPASS Setup Database (display label)	The active database specified in the **[Database][Setup]** menu choice (see 24.2, [Database], [Setup]). The merge buttons add data to or copy data from this database.
 (button)	Open a new database file.
Clear (button)	Clears the current selections.
All (button)	Selects all available setups in a database frame for the current **<Data to View>** selection.
 (button)	Transfer data selected in the **<Data to View>** list from the **<Merge Database>** to the **<Active COMPASS Setup Database>**.
 (button)	Transfer data selected in the **<Data to View>** list **from** the **<Active COMPASS Setup Database>** to the **<Merge Database>**.
 (button)	Delete the setup information selected in the **<Active COMPASS Setup Database>** frame. This is a fast way to remove multiple setups. The alternative is to remove setups individually from the appropriate editor. Dependencies of the selected setups are not deleted. For example a deleted test that specifies a specific reference or controller does not remove the support device information used by the reference and controller.
 (button)	The **[Clean Up]** option is used to remove fragmented records. Fragmented records are not visible within **COMPASS** yet consume database space. It is good practice to use this option whenever multiple records are removed by using the **[Delete]** button.

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25. REMOTE INTERFACING

25.1 OVERVIEW

The ability to communicate quickly and simply with a wide variety of devices is one of the most important features of **COMPASS**. Without this capability, the benefits of automation could not be fully realized as data acquisition and control functions would still have to be performed manually.

This section provides information on **COMPASS**'s facilities for interfacing with remote devices. This includes how commands are sent to devices, the formatting of responses, troubleshooting tips and overall interface timing.

COMPASS supports remote communications over RS232, TCP/IP and IEEE-488 interfaces. In general, initialization, set and read command sets with multiple discrete commands per set can be issued to complete a desired function. In many cases, multi-command sets are not needed. **COMPASS**'s highly versatile command structuring support and the near universality of RS232 and/or IEEE-488 interfaces on today's computers and test devices, make it possible to use just about any test device with remote communications capability with **COMPASS**.

COMPASS also supports a macro based interface. In this mode, **COMPASS** calls an **Interface Macro** at timed intervals (see 18.5.4, Interface Macros). The code within the macro can communicate with an instrument using any desired protocol. Most frequently, this type of interface is used to allow existing code to work the **COMPASS**. A user can compile an ActiveX control from existing code and access it within the macro.

There are two main interface types set up in **COMPASS**. Read interfaces are used when **COMPASS** must acquire data from a device such as a digital multi-meter used to read a DUT's output. Set interfaces are used to send control related commands directly to a controlling device. Each of these command sets usually include two types of commands: a) initialization commands to prepare to the device to set or read properly (not needed in all cases but indispensable in some); and b) the actual read or set commands. Read interfaces must always be set up so that the device responds in a specific, preplanned measurement unit; set interfaces must be structured to allow the current output target to generate a new remote command since the required target of any tests controller changes at different points in a test.

Most devices that support remote interfacing use a common text command and response format. Typically, commands are word fragments that resemble the function of the command. Responses to numerical query commands frequently output as a direct numerical value or a condensed string with the number embedded. Some devices require ASCII control codes as part of the command and include other codes as part of the response. Control codes are frequently specified in the device documentation as non-printable hexadecimal characters, e.g., 04H or H04. **COMPASS** is designed to handle all of these cases. The **<Process Response>** and **<Command>** features provide access to **COMPASS** Macros. Using VB Script, a **COMPASS** macro can format commands and responses to conform to almost any device requirement.

All device commands used by **COMPASS** are created using the Remote Command Editor. The **[Output]** and **[Set]** device setup tabs provide links to the Remote Command Editor when a corresponding device range uses a remote interface.

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It is critical to check the <No Response> option for commands that do not respond. This will prevent COMPASS from timing out while waiting for a response.

25.2 RS232 INTERFACE

RS232 is one of the most widely used interface standards. Until the recent proliferation of USB, at least one RS232 port was built into every IBM compatible computer. The interface connects two devices in a full duplex fashion so that both devices can talk simultaneously. The connection requires that the RS232 receive line of one device is connected to the transmit line of the second device and visa versa. In addition to this connection, some devices require the connection of "handshaking" lines to signal the beginning and the interface conversation.

To set up an RS232 device, an RS232 cable must be connected between the device and the computer. The port on the computer must be specified along with the settings of the remote device. The computer's RS232 port must be specified and the settings of the port must be adjusted to the settings of the remote device. **COMPASS** provides setup features to facilitate this step. Refer to the device's manual to determine how to retrieve the RS232 settings.

25.2.1 RS232 SETUP

If the remote interface selection is RS232, the **<RS232 Settings>** screen must be used to **specify** the specific RS232 setting information. Refer to section 4.3.5 for information on the RS232 Settings and their meanings. The **<RS232 Settings>** screen is called in **COMPASS** by clicking any of the RS232 settings displayed. Select the correct settings for the device from the drop down lists and click **[OK]** when ready. All settings, with the exception of the **<COM Port>**, are defined by the device that will use the interface. Refer to the instruction manual of that device to determine these settings and make any necessary selections for the interface to function in RS232. The **<COM Port>** selection should represent the physical connection of the device and an RS232 port on the host computer or the currently configured reference device.

Use the **<Ref Com2>** selection found at the end of the **<COM Port>** drop down list to access the currently configured reference COM2 port rather than a standard communications port on the host PC. **<Ref Com2>** is usually COM2 of a PPC pressure reference or controller. If the reference device does not have a valid COM2 port, **COMPASS** will generate an error when trying to access the port. No special command setup is required to use the **<Ref Com2>** option. Select this option just as any other COM port selection, **COMPASS** will set up the reference device COM2 port and modify the commands as needed to send and receive commands using this interface.

If the desired communications port is available on the PC but not listed as an available RS232 port, use **[Tools]**, **[Options]**, **[Interface]** to prevent **COMPASS** from auto detecting the RS232 ports.

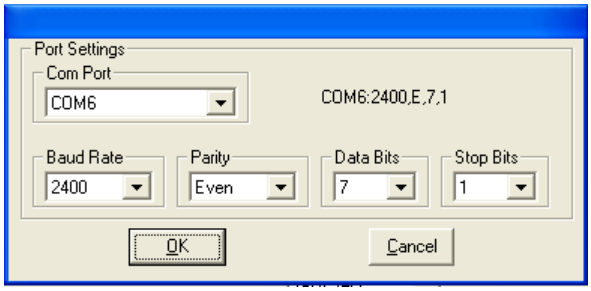

Figure 196. <RS232 Settings> Panel

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25.2.2 DHI DEVICE COM2

Many **DHI** products support a pass-through communications port on the back panel of the product labeled COM2. This feature allows a single PC interface to be used to communicate with 2 instruments. The main PC interface (RS232 or IEEE-488) will communicate with the **DHI** product. Pass through commands sent to the product will read and write data to the instrument connected to COM2 of the product. Only instruments that use an RS232 interface with settings available on the **DHI** product can use this feature.

COMPASS automatically handles the setup and use of **DHI** COM2 ports when appropriate. During test initialization, select the COM port that corresponds to the **DHI** product to use. This function is valid only when the parent **DHI** product is a DUT, pressure reference or pressure controller. With few exceptions, the instrument using the COM2 port can be used for any purpose.

DUTs that are DHI products cannot use the COM2 port of the reference or controller. During Test Initialization, the reference and controller are selected after a DUT (see 7.3, Test Initialization). Therefore the remote settings to the reference and/or controller are not available when the DUT is setup. However, a DHI reference or controller can use the COM2 port of a DHI DUT.

The supported COM2 ports are typically at the top of the COM Port list in the port settings dialog (see **Figure 197**). The available options are:

Ref COM2 The reference must be a **DHI** product. This feature is not available to **DHI** DUTs.

SET COM2 The test pressure controller must be a **DHI** product. This feature is not available to **DHI** DUTs.

DUT COM2 The DUT must be a **DHI** product that has a COM2 port.

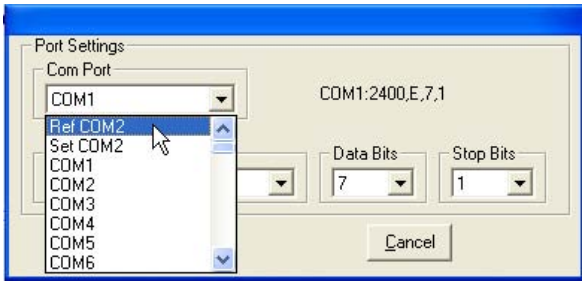

Figure 197. DHI COM2 Ports

25.3 IEEE-488 INTERFACE

IEEE-488, also known as GPIB (General Purpose Interface Bus), is a popular device interface protocol. This interface allows a single IEEE-488 controller card to simultaneously interface with up to 15 devices. Each device must be set to an independent IEEE-488 address from 1 to 30. The controller card also has an address that is used when multiple IEEE-488 cards are installed in the PC. However, this is a rare case.

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To use IEEE-488 with **COMPASS**, use the **[Tools][Options], [Interface]**, **<IEEE-488 Card>** option to select the IEEE-488 card installed in your PC. When this selection is made, no other card related selections are required, only the device IEEE-488 address must be specified. Each device in an IEEE change must use a unique IEEE-488 address. Refer to the device documentation for more information on how to determine the device's IEEE-488 address.

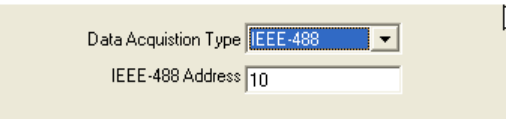

Figure 198. IEEE-488 Settings

25.4 TCP/IP

Transfer Control Protocol/Internet Protocol (TCP/IP) is an industry standard communication protocol that defines methods for packaging data for transmission between computing devices on a network. TCP/IP is the standard for data transmission over networks and is becoming a common device interface protocol. TCP establishes a connection for data transmission and IP defines the method for sending data packets. **COMPASS** provides communications with host TCP/IP devices by using the host PC's network interface card. **COMPASS** can communicate with the device at any point on the physical network.

To use this protocol, the devices TCP/IP address must be available. Enter the address in the **<TCP/IP Host(IP)>** field. The address can be a text host name value or in the numeric IP address format ("102.168.200.200"). The **<TCP/IP Port>** is the mechanism that allows a computer to simultaneously support multiple communication sessions with computers and devices on a network. A port is basically a refinement of an IP address; a computer that receives a packet from the network can further refine the destination of the packet by using a unique port number that is determined when the connection is established. By default, **COMPASS** uses 1001 as the port value. It is not necessary to change this setting unless a conflict with other ports exists.

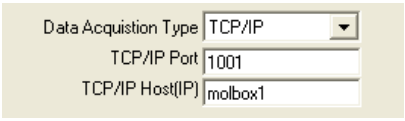

Figure 199. TCP/IP Settings

25.5 HART VIA RS232

COMPASS provides basic HART support to read the primary variable and loop current of HART enabled devices. Complete functionality of a HART master is not provided. The device must be set to the desired range and unit of measure prior to starting a test.

COMPASS accesses HART devices by using an RS232 to HART converter. The available interface options are identical to the RS232 Interface options (see 25.2.1, RS232 setup). There are many converters available on the market today. The RS232 settings required by each converter may differ between manufacturers. Typical RS232 settings used by HART to RS232 converters are: 1200 Baud, Odd Parity, 8 Data Bits, 1 Stop Bit (1200,O,8,1), no **<Command Terminator>**, no **<Response Terminator>**, and **<Binary>** commands selected (see **Figure 200**). The **<RTS ON/OFF>** handshaking option should be used to set the RTS line high while sending data to the HART device (see 4.3.5, [Communications] Tab).

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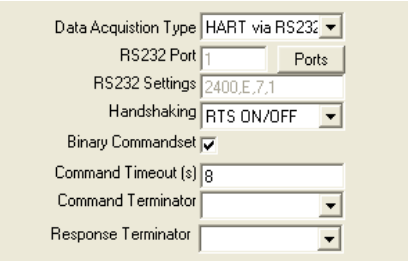

Figure 200. Typical HART via RS232 Settings

Only 1 HART device is supported for each converter. The hardware should be connected as described by **Figure 201** unless otherwise specified by the converter documentation.

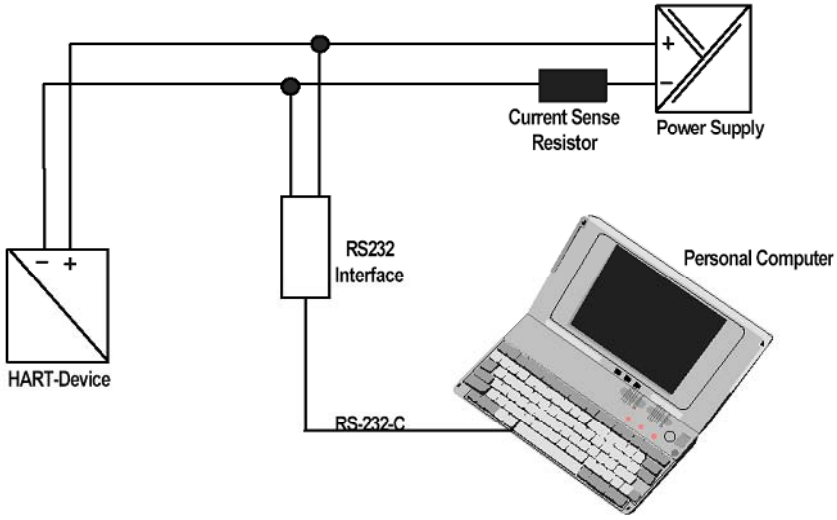

Figure 201. HART DUT to PC Connection

25.5.1 HART OUTPUT REQUIREMENTS

Creating a device that uses the HART via RS232 interface option is no different than creating any other device in **COMPASS**. However, **COMPASS** makes a few assumptions based on the raw output type of the device. All relationship selections between the raw output and final output still follow the relationship rules of **COMPASS** (see 4.3.6.2, Output Relationship Editor). It is up to the user to provide the proper settings for the device just like any other remote device used by **COMPASS**.

When the raw output type is current or voltage and the output source is HART via RS232, **COMPASS** uses Universal HART command 2 to obtain the device output. Reading the loop current is required when calibrating the loop current of the HART device or when the process monitored by the HART device uses the loop current as the reference. Most transmitters use a 4-20mA raw output that is linearly proportional to the final output pressure range. The range entered should correspond to the range of the device. The loop current to range configuration of the device must be set to the configuration used by **COMPASS** prior to starting at test.

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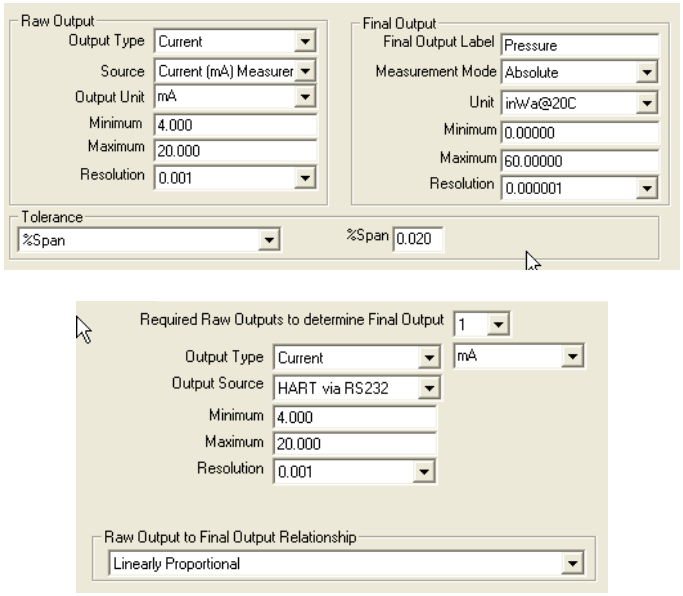

Figure 202. HART Relationship settings for current outputs

Any raw output type that is not current or voltage is assumed to be the Primary Variable of the device when the output source is HART via RS232. The raw output type must be the output type of the Primary Variable of the HART device. **COMPASS** supports Primary Variable outputs of pressure, temperature, length and mass only. In this case **COMPASS** polls Universal HART Command 1 to obtain the output value. **COMPASS** automatically performs the necessary unit conversion from the unit output by the device to the selected unit of the raw output when necessary. For example, the HART device may output a pressure in inches of water yet the setup in **COMPASS** specifies a unit of psi. **COMPASS** will convert the inches of water output to psi. Again all relationship settings apply from this point on. In most cases, it is desirable to use **<Same>** as the relationship choice when reading the Primary Variable. This way, no manipulation (other than a unit conversion) of the output will occur.

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25.6 TERMINATION AND TIMEOUT

Interfaces settings common to all **COMPASS** supported remote interfaces are listed at the bottom of the interface setup screen on the **[Communications]** tab.

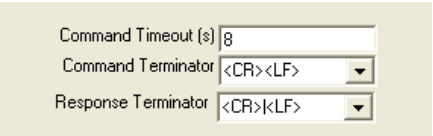

Figure 203. Command Termination and Timeout

Table 95. Command Termination and Timeout Frame Labels

FRAME LABEL	DESCRIPTION
Command Timeout(s) (numeric entry)	The maximum length of time to wait for a response to a remote command. If a response is not received within this amount of time, a **COMPASS** timeout occurs.
Command Terminator (text entry/drop down list selection)	Defines how the device terminates command strings. The selected (or entered) value is automatically appended to the end of every command issued. Make sure that the terminator is not also included in the remote command setup. The selections available from the drop down list are: **<CR>** Carriage return, ASCII character 13 **<LF>** Line feed, ASCII character 10 **<CR><LF>** Carriage return line feed, ASCII characters 13 and 10. This is the most common selection and is selected by default. **“”** Delete all text in the field to not use a command terminator. Do not enter empty quotes. **COMPASS** sends only the exact text specified by the remote command to the remote device.
Response Terminator (text entry/drop down list selection)	Defines when **COMPASS** will consider an individual response to be complete. This option is not available in IEEE-488 communications. With IEEE-488 there are hardware level assertions that define the end of a command and response. The selections available from the drop down list are: **<CR>** Carriage return, ASCII character 13 **<LF>** Line feed, ASCII character 10 **<CR><LF>** Carriage return line feed, ASCII characters 13 and 10. This is the most common selection and is selected by default. **<CR>|<LF>** Carriage return **OR** line feed must be detected in the device response. ASCII characters 13 or 10. **>#** Read at least “#” characters from the RS232 buffer before assuming the response is complete. No physical buffer limitations are imposed. When # characters are received from the remote device the response data is used by **COMPASS**. This type of termination is useful when a final character is not used to mark the end of a response. **<#** **COMPASS** limits the RS232 buffer to # characters. When the buffer is full the response is considered complete and the data in the buffer is used by **COMPASS**. This type of termination is useful when the remote response is always a fixed number of characters. **“”** Delete all text in the field to not use a response terminator. Do not enter empty quotes. **COMPASS** assumes that any response is complete when data has been retrieved from the remote device and new data is not received for 300ms. If no data is returned from the device a Timeout error occurs. This is really a safety feature, to prevent false device time-outs in the many devices that do not have a specific **<Response Terminator>**.

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26. UNIT CONVERSIONS

All unit conversions and custom units are handled by the **DHI**, Unit of Measure Converter. Run the Unit of Measure Converter as a stand-alone application using the program group icon, or use the **[Tools]**, **[Unit of Measure Converter]** option in **COMPASS**. The **[Options]** menu in the Unit of Measure Converter contains features to allow custom units creation. Custom units created in this way are available throughout **COMPASS**. Refer the help menu of the Unit of Measure Converter for details on units conversion factors, supported units and custom unit creation.

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27. DATA FILES

Data files (*.dat) are the files created by **COMPASS** to store the data relating to a test run on a DUT using **[Run Test]** or **[Run Manual Test]**. Data Files can be viewed, edited, printed and made into custom reports all within **COMPASS**. Data Files are designed for easy export into third party applications, such as spreadsheets or device management software. Optionally, Data Files can be added to a database for further manipulation or storage.

27.1 DATA FILE CREATION

At the beginning of a test, a Data File (*.dat) is created. A separate data file is created for each DUT in a test. If no DUTs are selected during test initialization, one file is created. This file contains all the details on the test (reference information, DUT information, test information) and test data is logged to it as the test runs. The exact information logged in the Data File can be controlled using **[Tools]**, **[Options]** menu choices (see 14.9, [Data In File] Tab and 14.10, [Data Header] Tab).

If a spreadsheet is used to manipulate COMPASS Data Files, it is not recommended to modify the information logged to a Data File using the [Tools], [Options] menu. When the file structure is changed, the relative cell orders in the spreadsheet must also change.

If a test is aborted before test conclusion is reached, the **[Tools]**, **[Options]**, **[Data File]** tab setting determines whether **COMPASS** queries the operator as to whether to keep or delete the partial Data File or the Data File is automatically deleted by **COMPASS** (see 14.8**,**[Data File] Tab**)**.

27.2 NAMING AND STORING DATA FILES

Data files are named and stored automatically. The default directory for **COMPASS** Data Files is "\data*DUTIDinfo**.dat". The "DUTIDinfo" sub-directory is created automatically by **COMPASS** using the DUT information selected on the **[Tools]**, **[Options]**, **[Data File]** tab (see 14.8**,**[Data File] Tab**)**. By default, the DUT serial number is used (specified in the DUT Definition). The DUT based sub-directories are automatically created by **COMPASS** at the designated location.

The automated Data File name follows one of two formats determined by the **[Tools]**, **[Options]**, **[Data File]** tab preference. Realize that this is a default file name and that all complete Data Files can be renamed using the **[Re-Name]** option on the Test Complete dialog at the end of a test.

Long Data File naming is used by default. This name is formatted as **YYYY_ddd_rrr** where:

YYYY Is the four digit year.

ddd Is the three digit day of the year (Julian date). e.g., 001 for January 1 and 365 for December 31.

rrr Represents the test run number on the DUT being tested for the current day. This indicator increments from 000 to 999.

Short Data File naming displays as **YYdddrrr** where:

YY Is the two digit year.

ddd Is the three digit day of the year (Julian date). e.g., 001 for January 1 and 365 for December 31.

rrr Represents the test run number on the DUT being tested for the current day. This indicator increments from 000 to 999.

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The use of the Julian date in the default Data File name is intended to maintain sequential file order in a given directory. If you wish to find a file based on a given test date, do not interpret the Julian date into a common date format. Instead, use the date sorting capabilities of the Windows file browser. Choose the [Show Details] option and click the column named <Modified>. Files are listed in ascending or descending order.

COMPASS's automatic naming convention for Data Files makes it possible for two *.dat files to have the same name. However, the two files will always be stored in different directories since they would have to be for DUTs with different identifications. To avoid conflicts or accidental overwrites when moving Data Files to new locations, the user should keep in mind that different Data Files might have the same name.

27.3 DATA FILE STRUCTURE

The information logged in the Data File is dependent on the **[Tools]**,**[Options]**; **[Data File]**, **[Data Header]** and **[Data In File]** options. Data Files have 6 distinct sections: General Header, Test Header, Device Header, Pre-Test, Test Data, and Notes. With few exceptions, each Data File section begins with brackets describing the section; [Test Data] for example. The next line is a delimited list of titles for each field in the section. This line is followed by a line of actual data that corresponds to the section title information. **Table 96** describes these sections. Refer to section 21.5 (Database Tables and Fields. for details on the actual data logged in the test data file.

Table 96. Data File Structure

General Header Describes non test specific settings such as date, user and station id.	**COMPASS** Version ASCII value of delimiter. [GENERAL INFORMATION] General header labels
Test Header Test specific information is stored in this section. In particular, control and data collection settings stored in the Test Definition.	[TEST INFORMATION] Test information labels Test information data
Device Header Device Definition header and output information is stored in this section. There is a separate header for each device specified on the **[Tools]**,**[Options]**, **[Data Header]** tab (see 14.10, [Data Header] Tab). Each section is labeled based on the device the section represents.	[DUT] DUT information labels DUT data labels [Reference] Etc.
Pre Test Leak test and pressure cycle settings are listed in this section.	[PRE TEST] Pre test information labels Pre test data.

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Test Data Only test data specifically selected for use in the data file is logged to the data file (see 14.9, [Data In File] Tab). Test data is segregated by sections specific to each type of cycle. These cycle labels are present even when the specific cycle type was not executed.	[TEST DATA] [TEST TEMPERATURE] Test data identifier code used to parse the data file. Test data labels. Delimited unit line corresponding the columns of test data. [TEST LINE PRESSURE] [TEST PRESSSURE CYCLE] Data logged at each test point. A new [TEST PRESSURE CYLE] section is recorded for each test pressure cycle. A new [TEST LINE PRESSSURE] section and all subsequent [TEST PRESURE CYCLE] sections are recorded for each test line pressure point. A new [TEST TEMPERATURE] section and all subsequent [TEST LINE PRSSURE] and [TEST PRESSURE CYCLE] for each test temperature point.
Test Notes	[NOTES] Multi line test notes specified by the user at the end of a test.

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28. COMPASS OBJECTS

28.1 OVERVIEW

COMPASS for Pressure functionality is highly expandable by the use of macros. Macros can be used to change and read the state of objects in **COMPASS**. Each **COMPASS** object has a unique set of properties and methods that are accessible to macros. The following sections describe the unique characteristics of each object. **Table 97** summarizes the different object types and use.

In many cases, it is not necessary to access COMPASS objects within a macro to achieve the desired functionality.

Table 97. COMPASS Object Summary

OBJECT NAME	DESCRIPTION
Test Data Class	The information stored in a **COMPASS** Test Data File can be accessed with this class. Both **COMPASS for Pressure** and the **COMPASS** Report Editor use this class to read and write data file information. The Test Data Class is used as an argument in Data File and Report Macros. Manipulate the properties in the class to calculate new data our outputs for reporting.
Test Definition Class	Virtually all selections available in a Test Definition are accessible using the **Test Definition Class**. This class is most frequently used to change test dwell and averaging times based on test conditions. This class is accessed as a property of the **COMPASS Class** or as a parameter in a **Test Macro**.
Device Class	Macros do not use this class as a standard argument. However, the Range Class and Calculation Classes both have properties that provide access to this class. All properties of an instrument defined in one of the **COMPASS** device editors can be accessed with the Device Class. Use the Device Class for specific identification information and settings of a device as required by a macro.
Configuration Class	All instruments setup during the test initialization process are maintained and accessed using this class. The properties are references to the Calculation Classes used to determine the outputs of the configured instruments. Use the Configuration Class to access a specific instrument within a macro.
Range Class	Use this class to access the properties defined in the Output Relationship Editor for a specific device output. The Range Class properties are typically required for output manipulation in Relationship Macros.
Calculation Class	The Calculation Class combines all objects required to determine the output of an instrument or to control its output. The Calculation Class typically maintains one or more Range Classes. The number of classes used is determined by the number of raw outputs selected in the Output Relationship Editor. Use this class to read the output of an instrument or set a new target within a Test Macro.

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OBJECT NAME	DESCRIPTION
COMPASS Class	The **COMPASS** Class is the only global object provided by **COMPASS** within a macro. Many of the toolbar functions in **COMPASS** that are available when running tests can be accessed by this function. This gives users the ability to repeat tests points and pause the test within a macro. Access to the Configuration Class is also available. The **COMPASS** Class is the only **COMPASS** object that supports events. This functionality is provided because this class is the OLE interface to the **COMPASS for Pressure** main program. Other than using macros to alter the sequence of a test, a host program can be developed to respond to the events of the **COMPASS** Class.

28.2 OBJECT CONSTANTS

There are many properties in the macro objects that return an integer value that represents an action or a quantity. The following tables list the potential property values and the corresponding definition.

28.2.1 PRESSURE UNIT CONSTANTS

Table 98. Pressure Unit Constants

VALUE	DESCRIPTION
-1111	%DUTSpan
0	MPa Mega Pascal
1	Pa Pascal
2	mbar milli bar
3	kPa kilo Pascal
4	Bar
5	mmWa @ 4°C
6	mmHg@ 0°C.
7	Torr
8	mTorr
9	psi
10	psf
11	inWa@ 4°C
12	inWa@ 20°C
13	inWa60 @ 60°F
14	inHg @ 0°C .
15	kcm2
16	mPa
17	mWa@ 4°C
18	ATM
19	cmHg@0
20	cmWa @4°C
21	dyn/cm^2
22	ftHg
23	ftWa@39F
24	ftWaC conventional ft of Water
25	gfcm grams force per sq cm
26	inHg@32F
27	inHg@60F
28	inWa@39F

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VALUE	DESCRIPTION
29	kgm^2
30	$kgmm^2$
31	kip/in
32	pdlf poundal /square foot
33	lbf^2 pound Force / square foot
34	lbin pound force /square inch
35	inWaC conventional inches of Water
36	cmWaC convetional cm of Water
37	mmWaC conventional mm of Water
38	hPa
39	ft feet altitude unit
40	m meters altitude

28.2.2 PRESSURE MEASUREMENT MODE

Table 99. Pressure Measurement Mode Constants

VALUE	DESCRIPTION
0	Absolute measurement mode
1	Gauge measurement mode
2	Absolute by ATM measurement mode

28.2.3 TEMPERATURE UNITS

Table 100. Temperature Unit Constants

VALUE	DESCRIPTION
0	C – Celsius
1	F – Fahrenheit
2	K – Kelvin
3	R - Rankin

28.2.4 MANUAL/AUTOMATIC

Table 101. Manual/Automatic

VALUE	DESCRIPTION
0	Manual dwell or averaging
1	Timed dwell or averaging

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28.3 TEST DATA CLASS

The Test Data Class is used to access data stored in data files and in the **COMPASS** test data database. This class is an ActiveX control that can be accessed by other programs as well as macros within **COMPASS**. Data in this class should not be changed while running a test. Edit data using a Report or Test Macro to customize a report.

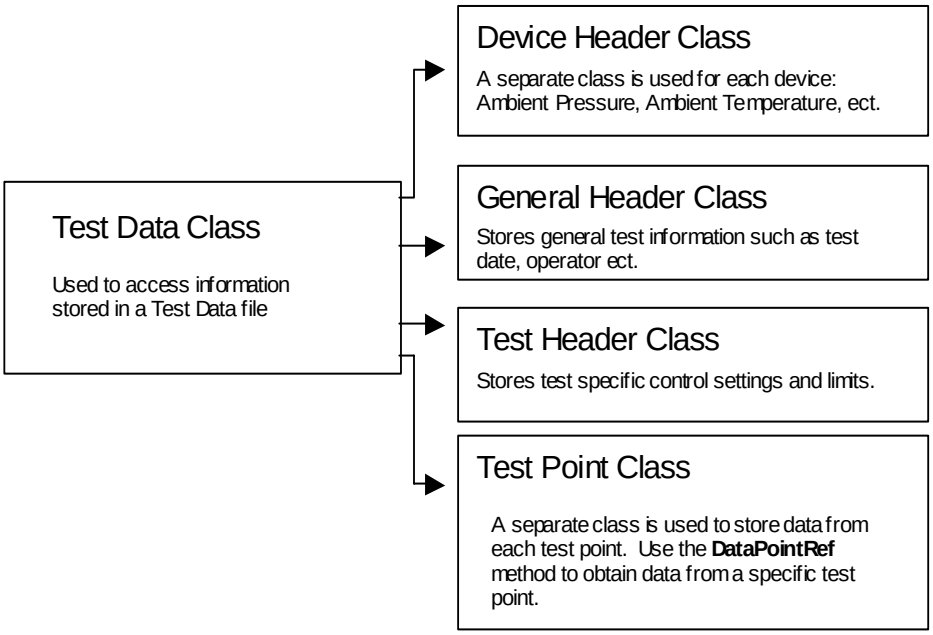
Test Data Class
Used to access information stored in a Test Data file
Device Header Class
A separate class is used for each device: Ambient Pressure, Ambient Temperature, ect.
General Header Class
Stores general test information such as test date, operator ect.
Test Header Class
Stores test specific control settings and limits.
Test Point Class
A separate class is used to store data from each test point. Use the DataPointRef method to obtain data from a specific test point.

Figure 204. Test Data Class Object Model

28.3.1 PROPERTIES

Properties with a Device Header Class data type are logged in the test data file only when specified in [Tools],[Options], [Data Header] (see 14.10, [Data Header] Tab).

Table 102. Test Data Class Properties

PROPERTIES	DATA TYPE	DESCRIPTION
ActiveUser	**String**	The user defined in the test data file.
AmbPres	**Device Header Class**	The device used to measure ambient pressure.
AmbTemp	**Device Header Class**	The device used to measure ambient temperature.
AmbRH	**Device Header Class**	The device used to measure ambient humidity.
Aux1, Aux2,… Aux10	**Device Header Class**	The device used to measure auxiliary data devices 1 to 10.
DUT	**Device Header Class**	The device under test information.
DUTRaw1	**Device Header Class**	The instrument used to measure the first raw output of the DUT. When the DUT has a remote interface, this information is typically the same as the DUT.

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PROPERTIES	DATA TYPE	DESCRIPTION
DUTRaw2	**Device Header Class**	The instrument used to measure the second raw output of the DUT. This data structure is not populated unless the DUT actually is setup to use a second raw output.
DUTRaw3	**Device Header Class**	The instrument used to measure the third raw output of the DUT. This data structure is not populated unless the DUT actually is setup to use a third raw output.
FileName	**String**	The file name of the data file used as a source of information for the Test Data Class.
GeneralHeader	**General Header Class**	Data structure information used to describe general data file information.
Notes	**String**	Text string containing the current test notes.
NumberofLinePressurePoints	**Integer**	The number of line pressure points specified in the Test Definition.
NumberofPressurePoints	**Integer**	The number of test pressure points specified in the Test Definition.
NumberofPressureCyclePoints	**Integer**	The number of pressure cycle points specified in the Test Definition.
NumberOfTemperaturePoints	**Integer**	The number of temperature points specified in the Test Definition.
ReadLinePres	**Device Header Class**	The instrument used to measure the test line pressure.
ReadTemp	**Device Header Class**	The instrument used to measure the test temperature.
Ref	**Device Header Class**	The instrument used to measure the reference pressure.
RefRaw1	**Device Header Class**	The instrument used to measure the first raw output of the reference pressure device.
RefRaw2	**Device Header Class**	The instrument used to measure the second raw output of the reference device. This data is set only when the reference requires more than one raw output instrument.
RefRaw3	**Device Header Class**	The instrument used to measure the second raw output of the reference device. This data is set only when the reference requires more than two raw output instruments.
SetLinePres	**Device Header Class**	The instrument used to control the test line pressure.
SetPressure	**Device Header Class**	The instrument used to control the test pressure.
SetTemp	**Device Header Class**	The instrument used to control the test temperature.
TestHeader	**Test Header Class**	Test definition specific settings and test criteria are maintained in this structure.

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28.3.1.1 DEVICE HEADER CLASS

The Device Header Class is used to store the setup information of devices used in a test. This information is not logged or available in the data file unless specified in **[Tools]**,**[Options]**, **[Data Header]** (see 14.10, [Data Header] Tab) prior to running the test. The data members of the Device Header Class are listed below. Not all data members are valid for all device setups. For example, piston gauge information is not available unless the corresponding device is a piston gauge.

PROPERTIES	DATA TYPE	DESCRIPTION
CalDueDate	**String**	The next required calibration date of the device.
CalibrationCoefficients1	**String**	Generic calibration information string. The field can be used anyway desired. A combination of string and numeric data can be written in the field. Various delimiting techniques can be used to extract numeric calibration data from the string value.
CalibrationCoefficients2	**String**	See **CalibrationCoefficients1**.
CalibrationCoefficients3	**String**	See **CalibrationCoefficients1**.
CalibrationCoefficients4	**String**	See **CalibrationCoefficients1**.
CalibrationCoefficients5	**String**	Only **COMPASS** macros can read or set data in this field. See **CalibrationCoefficients1**. The data in the field is written to the data file and available for reporting.
CalibrationCoefficients6	**String**	Only **COMPASS** macros can read or set data in this field. See **CalibrationCoefficients1**.
CustomerID	**String**	A unique identifier to associate with a customer.
DAQMethod	**String**	Method with which information was relayed to the device.
DatabaseID	**Long**	Database primary key for the device.
DWTGravity	**Single**	The gravity assigned to a deadweight tester mass set. The value is always specified in m/s².
FinalOutputMax	**Single**	Maximum final output value.
FinalOutputMin	**Single**	Minimum final output value.
FinalOutputSpan	**Single**	Difference between the maximum and minimum final outputs.
FinalOutputTolorance1	**String**	String representing the first tolerance segment.
FinalOutputTolorance2	**String**	String representing the second tolerance segment.
FinalOutputTolorance3	**String**	String representing the third tolerance segment.
FinalOutputTolorance4	**String**	String representing the fourth tolerance segment.
HeadHeight	**Single**	The pressure head correction height. The value is always in cm.
HeadMedium	**String**	The medium used to determine the pressure head correction.
Label	**String**	Device record label.
LastCalDate	**String**	Date the device was last calibrated.
Manufacturer	**String**	The manufacturer of this device.
MassBellDatabaseID	**Long**	The primary database key of the mass bell used with the device.
MassBellMass	**Single**	The mass bell mass in kg.
MassBellSerialNumber	**String**	The serial number of the mass bell used with the device.
MassSetDatabaseID	**Long**	The primary database key of the mass set.
MassSetSerialNumber	**String**	The serial number of the mass set.

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PROPERTIES	DATA TYPE	DESCRIPTION
MassSetTotalLoad	**Single**	Mass set total mass in kg.
MassUnit	**String**	The unit associated with the mass load. For piston gauges, the value is always kg. Deadweight testers will use a pressure unit.
MeasMode	**String**	Pressure measurement mode of pressure output and controlling devices.
Model	**String**	Manufacturer's model number.
PistCyl1DatabaseID	**Long**	Primary database key for the first piston-cylinder used for the device.
PistCyl1EffectiveArea	**Single**	Effective area in mm² for the first piston-cylinder used for the device
PistCyl1KN	**String**	Nominal pressure to mass relationship for the first piston-cylinder used for the device.
PistCyl1SerialNumber	**String**	Serial number for the first piston-cylinder used for the device.
PistCyl2DatabaseID	**Long**	Primary database key for the second piston-cylinder used for the device.
PistCyl2EffectiveArea	**Single**	Effective area in mm² for the second piston-cylinder used for the device
PistCyl2KN	**String**	Nominal pressure to mass relationship for the second piston-cylinder used for the device.
PistCyl2SerialNumber	**String**	Serial number for the second piston-cylinder used for the device.
Piston Information		Note available with most devices.
RawOutputMax	**Single**	Maximum raw output value.
RawOutputMin	**Single**	Minimum raw output value.
RawOutputRelationship	**String**	Describes how the raw output becomes the final output.
RawOutputSpan	**Single**	Difference between the maximum and minimum raw outputs.
SerialNumber	**String**	Manufacturer's serial number.
UserID	**String**	Operator assigned ID number.

28.3.1.2 GENERAL HEADER CLASS

The **General Header Class** contains fields used to describe general test and data file information.

PROPERTIES	DATA TYPE	DESCRIPTION
Date	**String**	The date that the data file was created.
Time	**String**	The time that the data file was created.
Delimiter	**String**	The data file delimiter used to separate data fields in the data file.
UserID	**String**	The test operator.
SoftwareTitle	**String**	The title and version of the program used to generate the data.
StationID	**String**	The station identification value setup in **COMPASS** (see 24.2, [Database], [Setup])
DLLVersion	**String**	The version of the Test Data Class.

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28.3.1.3 TEST HEADER CLASS

The **Test Header Class** contains fields specific to the Test Definition used to run a test. Refer to section 8, [Setup], [Test] for more detail on the fields contained in this section.

PROPERTIES	DATA TYPE	DESCRIPTION
Label	**String**	The test record label. The text is "Manual TEST" when a manual test was executed to generate the data file.
DatabaseKey	**Long**	The database key of the test definition used.
CompleteTestCycles	**Integer**	The number of complete test cycles specified in the Test Definition.
PresDwell	**String**	The test pressure dwell time. The value is either "Manual" or the numeric dwell time value.
PresHoldLimit	**String**	The test pressure hold limit and unit.
PresSSLimit	**String**	The test pressure stability limit and unit.
PresSSTime	**Integer**	The test pressure ready hold time.
PressSSTimeout	**Integer**	The pressure ready time-out.
PresUseReady	**String**	"Yes" or "No" depending on the test pressure controller Use Ready Test Definition selection.
NumPresPnts	**Integer**	The number of test pressure points defined in the Test Definition.
NumPresCycles	**Integer**	The number of test pressure cycles defined in the Test Definition.
PresAvgTime	**Integer**	Test pressure averaging time.
PresJog	**String**	"Yes" when the test pressure jog function was enabled and "No" otherwise.
PresRegulate	**String**	The time in seconds between test pressure regulation updates or "No".
PresCtrlMode	**String**	Pressure control mode used for DH Instruments pressure controllers, "Static" or "Dynamic".
PresMeasMode	**String**	Test pressure measurement mode.
LocalGravity	**Double**	The configured local gravity value in **[Tools]**, **[Options]**, **[Piston Gauge]** (see 14.6, [Piston Gauge] Tab).
LinePresDwell	**String**	The line pressure dwell time. The value is either "Manual" or the numeric dwell time value.
LinePresHoldLimit	**String**	The line pressure hold limit and unit.
LinePresSSLimit	**String**	The line pressure stability limit and unit.
LinePresSSTime	**Integer**	The line pressure ready hold time.
LinePressSSTimeout	**Integer**	The pressure ready time-out.
LinePresUseReady	**String**	"Yes" or "No" depending on the line pressure controller Use Ready Test Definition selection.
NumLinePresPnts	**Integer**	The number of line pressure points defined in the Test Definition.
LinePresJog	**String**	"Yes" when the line pressure jog function was enabled and "No" otherwise.
LinePresRegulate	**String**	The time in seconds between line pressure regulation updates or "No".
LinePresCtrlMode	**String**	Pressure control mode used for DH Instruments pressure controllers, "Static" or "Dynamic".
LinePresMeasMode	**String**	Line pressure measurement mode.
TempDwell	**String**	The test temperature dwell time. The value is either "Manual" or the numeric dwell time value.
TempHoldLimit	**String**	The test temperature hold limit and unit.

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PROPERTIES	DATA TYPE	DESCRIPTION
TempSSLimit	**String**	The test temperature stability limit and unit.
TempSSTime	**Integer**	The test temperature ready hold time.
TempsSSTimeout	**Integer**	The pressure ready time-out.
TempUseReady	**String**	"Yes" or "No" depending on the test temperature controller Use Ready Test Definition selection.
NumTempPnts	**Integer**	The number of test temperature points defined in the Test Definition.
TempJog	**String**	"Yes" when the test temperature jog function was enabled and "No" otherwise.
TempRegulate	**String**	The time in seconds between test temperature regulation updates or "No".

28.3.1.4 TEST DATA POINT CLASS

The Test Data Point Class stores all data for a single test point. This class cannot be accessed directly with properties of the Test Data Class. Instead, methods must be used to return an instance of the Test Data Point at a specific test point. A unique class is used for each temperature, line pressure, pressure cycle and test pressure point. Each output value in this class corresponds to the output of an instrument selected during test initialization. Not all fields are valid with all devices. For example, DUT information corresponding to a piston gauge is not available unless the DUT is a piston gauge.

PROPERTIES	DATA TYPE	DESCRIPTION
AmbientHumidity	**Double**	Ambient humidity.
AmbientPressure	**Double**	Ambient pressure.
AmbientTemperature	**Double**	Ambient Temperature
Aux1Final – Aux10Final	**Double**	The final output of any one of up to 10 auxiliary output devices.
Aux1Raw – Aux10Raw	**Double**	The Raw output of any one of up to 10 auxiliary output devices.
DateofPoint	**String**	The date of the test point in YYYYMMDD format.
DUTCounts	**Long**	The number of samples taken when averaging the DUT.
DUTDatabaseID	**Long**	The database key of the DUT definition.
DUTDiff	**Double**	The error between the DUT and the reference: DUT-Ref.
DUTMass	**Double**	The total mass on the DUT. The value is expressed in kg for piston gauges and in a pressure unit for deadweight testers.
DUTMassList	**String**	List of the individual masses used to obtain the total mass on the DUT. Each mass is delimited by a colon, ":". For example, "piston:bell:5kg:1kg".
DUTMaxPressure	**Double**	The maximum DUT pressure value recorded while averaging.
DUTMinPressure	**Double**	The minimum DUT pressure value recorded while averaging.
DUTPistonPosition	**Double**	The DUTs piston position at the time the point was taken.
DUTPistonRotation	**Double**	DUT piston rotation rate at the time the point was taken.
DUTPressure	**Double**	The DUT pressure.
DUTRawOutput1	**Double**	The un-manipulated raw output of the DUT.

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PROPERTIES	DATA TYPE	DESCRIPTION
DUTRawOutput2	**Double**	The un-manipulated second raw output of the DUT. This value is present only when the DUT has more than one raw output.
DUTRawOutput3	**Double**	The un-manipulated third raw output of the DUT. This value is present only when the DUT has three raw outputs.
DUTReferenceVacuum	**Double**	The residual vacuum around the DUT when the DUT is a piston gauge.
DUTStnDev	**Double**	The standard deviation of the average DUT pressure. If the DUT was not averaged, this value is not applicable.
DUTTemperature	**Double**	The DUT temperature at the time the point was recorded.
ElapsedTimeSec	**Single**	The test elapsed time.
ErrorFS	**Double**	The span error of the DUT.
ErrorRdg	**Double**	The reading error of the DUT.
FinalLinePressure	**Double**	The line pressure as output by the line pressure reference device.
FinalTempOutput	**Double**	The test temperature as output by the test temperature measuring device.
MacroDefined1 – Macrodefined10	**Double**	Macrodefined data that should be manipulated by macros. These fields are not directly used by **COMPASS**.
Point	**String**	A string representation of the test data point.
RefCounts	**Long**	The number of samples used to average the reference.
RefDatabaseID	**Long**	The database key of the reference device definition.
RefMass	**Double**	The total mass on the reference. The value is expressed in kg for piston gauges and in a pressure unit for deadweight testers.
RefMassList	**String**	List of the individual masses used to obtain the total mass on the reference. Each mass is delimited by a colon, ":". For example, "piston:bell:5kg:1kg".
RefMaxPressure	**Double**	The maximum pressure achieved by the reference during the averaging cycle.
RefMinPressure	**Double**	The minimum pressure achieved by the reference during the averaging cycle.
RefPistonPosition	**Double**	Reference piston rotation rate at the time the point was taken.
RefPressure	**Double**	The reference pressure.
RefRawOutput1	**Double**	The un-manipulated raw output of the reference.
RefRawOutput2	**Double**	The un-manipulated second raw output of the reference. This value is present only when the reference has more than one raw output.
RefRawOutput3	**Double**	The un-manipulated third raw output of the reference. This value is present only when the reference has three raw outputs.
RefReferenceVacuum	**Double**	The residual vacuum around the reference when the reference is a piston gauge.
RefStnDev	**Double**	The standard deviation of the average reference pressure. If the reference was not averaged, this value is not applicable.
RefTemperature	**Double**	The reference temperature output.
SetErrorFs	**Double**	The span error relative to the set point.
SetErrorRdg	**Double**	The reading error relative to the set point.
SetPointLinePressure	**Double**	The Test Definition specified line pressure target.

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PROPERTIES	DATA TYPE	DESCRIPTION
SetPointTemperature	**Double**	The Test Definition specified temperature target.
SetPointTestPressure	**Double**	The Test Definition specified test pressure target.
SetTime	**Integer**	The time required to set the test pressure.
Status	**String**	The status associated with a test point. •**T** – The DUT was out of tolerance. •**t** – The test pressure was not set within the specified pressure set timeout. •**E** - An error occurred either in a macro or while reading an instrument.
TimeofPoint	**String**	The time that the point was collected.
Tolerance	**Double**	The DUT tolerance expressed as a pressure for the test point.
UserDefined1 – UserDefined10	**Double**	Any one of up to 10 user defined outputs that are logged as a result of a macro when running a test.

28.3.2 METHODS

The Test Data Class methods must be used to read and write data to the data class.

Table 103. Test Data Class Method Summary

PROPERTIES	DATA TYPE	DESCRIPTION
DataPointRef	**Data Pont Class**	Use this method to access data from a specific data point. The function returns a reference to a data point class selected by the function arguments.

28.3.2.1 DATAPOINTREF

Purpose Obtain a reference to a specific Data Point Class. This reference allows the data at the point to be read and set.

Syntax `Function DataPointRef(iTemp, iLinePrs,iPCy, iPt, [bReadOnly])`

Arguments

- **iTemp** – The integer id of the desired test temperature point. Use 1 in the event that no temperature cycles were used.
- **iLinePrs** – The integer id of the desired test line pressure point. Use 1 in the event that no line pressure cycles were used.
- **iPCy** – The integer id of the desired test pressure cycle. Use 1 in the event that no pressure cycles were used.
- **iPt** – The collection index of the Test Data Class that is actively being reported.
- **bReadOnly –** True to prevent changes in the Data Point Class from affecting data stored in the Test Data Class.

Return Value **Test Data Point Class**

Remarks This method is used to access data in the data file within a macro. Report Macros and Data File Macros will most commonly use this method to manipulate data.

This method is frequently used in a loop determined by the number of points in the data file. There are several properties in the Test Data Class that can be used to determine the number of each type of point in the data file. For example, **NumberOfPressureCyclePoints** yields the number of pressure cycle points in the data file.

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28.4 TEST DEFINITION CLASS

The Test Definition Class is passed as a parameter to all **Test Macros** and is a standard property of the **COMPASS Class**. All aspects of a test created with the **Test Definition Editor** can be accessed with this class. Refer to section 8, **[Setup], [Test]** in this manual for details on the individual choices in a Test Definition.

Use this class to alter test execution. The test dwell time, averaging time, control settings and test points can be manipulated using this class. In most cases, a Test Event Macro or a Pre-Point Macro defined in a Test Definition is used to alter test parameters based on test conditions.

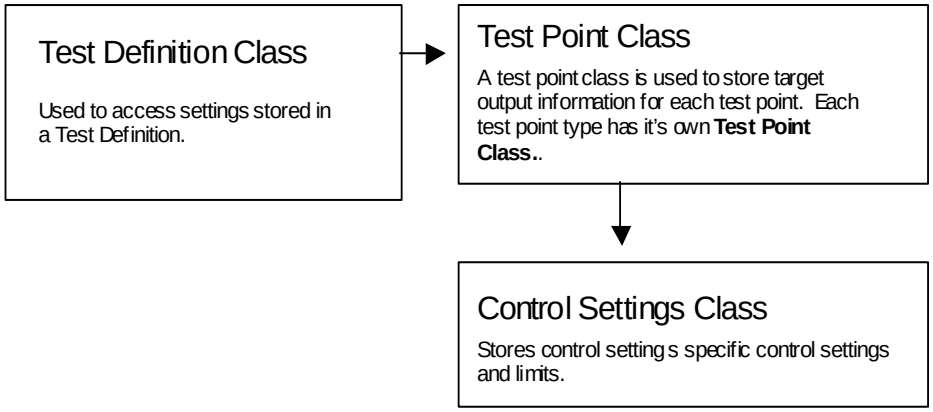
Test Definition Class
Used to access settings stored in a Test Definition.
Test Point Class
A test point class is used to store target output information for each test point. Each test point type has it's own Test Point Class..
Control Settings Class
Stores control settings specific control settings and limits.

Figure 205. Test Definition Class Object Model

28.4.1 PROPERTIES

Each property directly corresponds to a selection in the active Test Definition when running a test (see [Setup], [Test], 8).

Table 104. Test Definition Class Properties

PROPERTIES	DATA TYPE	DESCRIPTION
AutoVent	**Boolean**	The value represents the state of the **<Auto Vent After Each Test Cycle>**. When the value is TRUE, the test pressure is vented after each test cycle.
AvgTime	**Long**	The amount of time in seconds that data is averaged. The value is used only when the **AvgType** property is 1.
AvgType	**Integer**	The value determines how data is averaged in a test. • 0- Manual data is averaging is used. The user specifies when to start and when to stop averaging data. • 1– Test data is averaged automatically for the time duration specified by the **AvgTime** property.
Comment	**String**	Any comments associated with the Test Definition are accessed by this property.

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PROPERTIES	DATA TYPE	DESCRIPTION
CompleteTestCycles	**Integer**	The number of **<Complete Test Cycles>** specified in a Test Definition.
CycleAbortonFailure	**Boolean**	TRUE to abort a test when a timeout occurs setting the cycle pressure.
CycleMaxPressure	**Double**	The maximum target pressure to set when cycling pressure. The value is in the unit specified by **CycleUnit**.
CycleMinPressure	**Double**	The minimum target pressure to set when cycling pressure. The value is in the unit specified by **CycleUnit**.
CycleReps	**Integer**	The number of times to set the maximum and minimum cycle pressures.
CycleRun	**Boolean**	True when pressure cycling is active.
CycleSetTimeout	**Long**	The maximum amount of time in seconds to set a target pressure.
CycleUnit	**Integer**	The unit of measure specified for the pressure cycle.
Label	**String**	The label assigned to the Test Definition.
LeakAbortOnFailure	**Boolean**	TRUE to abort a test if a timeout occurs when setting the leak test target pressure.
LeakDwell	**Long**	The amount of time in seconds to wait after setting the leak test target pressure.
LeakDwellTime	**Long**	The leak test time in seconds.
LinePrsMeasMode	**Integer**	The test line pressure measurement mode. • 0 - Absolute • 1 - Gauge
LinePrsRegTime	**Long**	The time interval in seconds between line pressure adjustments when line pressure regulation is active.
LinePrsRegulation	**Integer**	Defines the type of line pressure regulation. • 0 – None • 1 – Regulate to the reference.
LinePrsRun	**Boolean**	TRUE when line pressure points are included in the test file.
LinePrsUnit	**Integer**	The test line pressure unit identifier.
PointP	**Test Points Class**	Test pressure point collection containing information for all test points. Access a point by specifying the point array index following code: **Object.PointP(4)** will return the 4th pressure point class.
PointLP	**Test Points Class**	Test line pressure point collection containing information for all test points. Access a point by specifying the point array index following code: **Object.PointLP(8)** will return the 8th line pressure point class.
PointT	**Test Points Class**	Test temperature point collection containing information for all test points. Access a point by specifying the point array index following code: **Object.PointT(5)** will return the 5th temperature point class.

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PROPERTIES	DATA TYPE	DESCRIPTION
TemperatureDwell	**Long**	The type of temperature dwell to use after the target temperature is set. • 0– Use manual dwell. The test operator must respond to a prompt to continue the test. • 1 – Automatic dwell. The dwell time is specified by the **TempeatureDwellTime** property.
TemperatureDwellTime	**Long**	The time in seconds to dwell after a test target temperature is set.
TemperatureRegTime	**Long**	The time in seconds between temperature output adjustments when temperature regulation is active.
TemperatureRegulation	**Integer**	Defines the type of temperature regulation. • 0 – None • 1 – Regulate to the reference.
TemperatureRun	**Boolean**	TRUE when temperature points are defined in the Test Definition.
TemperatureUnit	**Integer**	The test temperature unit identifier.
TestPrsCycles	**Integer**	The number of test pressure cycles to run.
TestPrsDwell	**Integer**	The type of test pressure dwell to use after the target pressure is set. • 0– Use manual dwell. The test operator must respond to a prompt to continue the test. • 1 – Automatic dwell. The dwell time is specified by the **TestPrsDwellTime** property.
TestPrsDwellTime	**Long**	The test pressure dwell time in seconds.
TestPrsMeasMode	**Integer**	The pressure measurement mode associated with the test pressure points.
TestPrsRegTime	**Long**	The time in seconds between test pressure output adjustments when test pressure regulation is active.
TestPrsRegulation	**Integer**	Defines the type of test pressure regulation. • 0 – None • 1 – Regulate to the reference • 2 – Regulate to the DUT.
TestPrsUnit	**Integer**	The unit of measure of the test pressure points.

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28.4.2 TEST POINT CLASS

The **Test Point Class** is a collection class that stores information on all test points. Edit the properties in this class to change the target point values in a test.

Table 105. Test Point Class

PROPERTIES	DATA TYPE	DESCRIPTION
Count	**Integer**	Read only property that returns the number of points.
DriverState	**Long**	The bitwise state of any valve drivers assigned to the current test point. If valve drivers 2 and 3 are active the value will be: $2^2 + 2^3 = 12$
LastSetDevice	**Control Settings Class**	A collection of control setting information. The property requires a test point argument and returns a single **Control Settings Class**. For example: object.LastSetDevice(1).HS will return the current hold setting.
ReadChange	**Boolean**	TRUE when the controller will change prior to setting the target output of the specified test point.
SetChange	**Boolean**	TRUE when the controller will change prior to setting the target output of the specified test point.
Target	**Double**	The target output for the test point. The units are specified in by the properties in the **Test Definition Class**.
TargetText	**String**	The text description of the target. Other than the numeric value of the target, **Min**, **Max** or **ATM** may be returned.

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28.4.3 CONTROL SETTINGS CLASS

The **Control Settings Class** is a collection of control settings for all points in a test. Edit the properties in this class to change control settings during a test. See section 3.3.5, Output Control for details on how control settings are used. Control settings are selected on the **[Set]** tab in a Test Definition.

Table 106. Test Point Class

PROPERTIES	DATA TYPE	DESCRIPTION
AutoGenDeadBand	**Single**	The automatic pressure generation deadband.
AutoGenerate	**Boolean**	TRUE when automatic pressure generation for a piston gauge is enabled.
AutoRotate	**Boolean**	TRUE when auto rotate is enabled for a PG7000 and FALSE otherwise.
HoldUnit	**Integer**	The unit of measure associated with the hold and stability limits.
HS	**Single**	Control hold setting in the defined **HoldUnit**.
SetMode	**Integer**	Determines whether Static or Dynamic pressure control is used.
SS	**Single**	The stability setting in the defined **HoldUnit**.
SSTime	**Integer**	The stability hold time in seconds.
Timeout	**Integer**	The stability timeout value in seconds.
UseReady	**Boolean**	TRUE when the Ready response of the active controller is used to determine when the output is set.

28.5 DEVICE CLASS

The Device Class stores information setup by users in any of the **COMPASS** device editors: DUT Editor, Support Device Editor, and Piston Gauge Platform Editor. Use this class in macros to access device level properties.

Within **COMPASS**, a Device Class contains collections of Range Classes that represent the outputs and sets of a device. However, macros access outputs and sets individually by using the appropriate Range Class or Calculation Class. Use the properties and methods of these classes to access the Device Class as required by a macro.

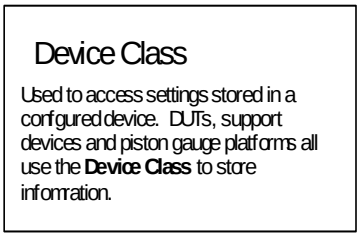
Device Class
Used to access settings stored in a configured device. DUTs, support devices and piston gauge platforms all use the **Device Class** to store information.

Figure 206. Device Class Object Model

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28.5.1 PROPERTIES

PROPERTIES	DATA TYPE	DESCRIPTION
AdvancedDevice	**Integer***	• 0 - Simple Pressure DUT • 1- Advanced DUT
CalDate	**String**	Last calibration date.
CalDueDate	**String**	Calibration due date.
CalInfo1	**String**	Generic calibration information string. The field can be used anyway desired. A combination of string and numeric data can be written in the field. Various delimiting techniques can be used to extract numeric calibration data from the string value.
CalInfo2	**String**	See CalInfo1.
CalInfo3	**String**	See CalInfo1.
CalInfo4	**String**	See CalInfo1.
CalInfo5	**String**	Only **COMPASS** macros can read or set data in this field. See CalInfo1. The data in the field is written to the data file and available for reporting.
CalInfo6	**String**	Only **COMPASS** macros can read or set data in this field. See CalInfo1.
CalTech	**String**	The name of the calibration technician that performed the last calibration.
CertID	**String**	The document tracking number or string for the last certification.
Comment	**String**	Text describing any special conditions of the setup.
CustomerNum	**String**	A unique identifier to associate with a customer.
DaqType	**Integer***	The method to use to communicate with the instrument. A device output can still use manual entry even when a remote interface is specified for the device (4.3.6.2.1). • 0 – Manual • 1 – RS232 • 2 – IEEE-488 • 4 – TCP/IP • 7 – Other Device • 8 – Macro • 9 - HART via RS232
DHIDevice	**Boolean***	TRUE when the **<Auto Detect Setup>** option is specified for a DH Instruments product (4.3.3). The value is FALSE otherwise.
Extra1	**String**	String space available for macro data storage. This field is not accessible to the user outside of a macro.
Extra2	**String**	See **Extra1.**
Extra3	**String**	See **Extra1**.
Extra4	**String**	See **Extra1.**
Extra5	**String**	See **Extra1.**
ID	**String**	Device Identification.
Key	**Long***	Device database key.
Label	**String**	Unique description used to identify the device setup in **COMPASS**.
LastModified	**String***	The date the device was last modified.
LastModifiedBy	**String***	The active **COMPASS** users when the device was last modified.
MandTE	**Boolean***	TRUE when the M&TE flag is specified for a device and FALSE otherwise.
Manufacturer	**String**	Device manufacturer.
Model	**String**	Device model.

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PROPERTIES	DATA TYPE	DESCRIPTION
ParamID	**String**	User defined identification value for a device. This value can be entered only during test initialization. It is used as a flag to handle similar devices differently. Particularly when devices require individual command addressing. This is frequently the case when instruments are connected using an interface chain.
RecordType	**Integer***	Type of information stored in the device. • 0 – Definition • 1 - Profile w/Range • 2 - Profile without Range
SetType	**Integer***	The interface to use to control the device. When the **SharedIO** property is TRUE, use the **DaqType** property instead. See **DaqType**.
SharedIO	**Boolean***	TRUE when the Set and Output interface of a device will use the same interface settings.
SN	**String**	Device serial number.

28.5.2 METHODS

Name **ShowRunDisplay**

Purpose Display the device run screen.

Syntax `Sub ShowRunDisplay()`

Arguments None

Return Value None

Remarks This method is equivalent to selecting the device run screen from the main toolbar (5.4.2).

Example N/A

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28.6 CONFIGURATION CLASS

The Configuration Class contains a reference to the Calculation Classes of all instruments controlled by **COMPASS** during a test. Refer to section 28.8 for details on the Calculation Class. All instruments in this object are selected during the Test Initialization process. Use the properties of this class to control and access instruments as required by a macro.

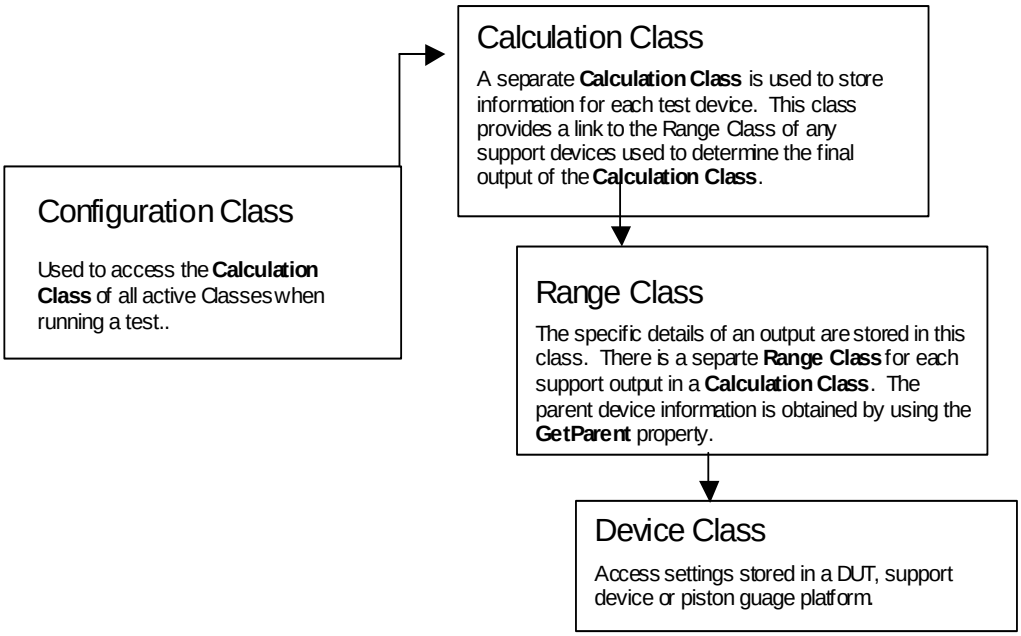
Calculation Class
A separate Calculation Class is used to store information for each test device. This class provides a link to the Range Class of any support devices used to determine the final output of the Calculation Class.
Configuration Class
Used to access the Calculation Class of all active Classes when running a test..
Range Class
The specific details of an output are stored in this class. There is a separte Range Class for each support output in a Calculation Class. The parent device information is obtained by using the GetParent property.
Device Class
Access settings stored in a DUT, support device or piston guage platform.

Figure 207. Configuration Class Object Model

28.6.1 PROPERTIES

PROPERTIES	DATA TYPE	DESCRIPTION
ActiveRefLP	**Integer**	The collection index of the active reference line pressure device. The value should be used with the **RefLinePrs** collection to access the calculation class of the active line pressure reference.
ActiveRefP	**Integer**	The collection index of the active reference pressure device. The value should be used with the **RefPrs** collection to access the calculation class of the active pressure reference.
ActiveRefSetLP	**Integer**	The collection index of the active line pressure controller. The value should be used with the **SetLinePrs** collection to access the calculation class of the active line pressure controller.
ActiveRefSetP	**Integer**	The collection index of the active reference pressure controller. The value should be used with the **SetPrs** collection to access the calculation class of the active test pressure controller.
ActiveRefSetTemp	**Integer**	The collection index of the active reference temperature controlling device. The value should be used with the **SetTemp** collection to access the calculation class of the active temperature controller.

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PROPERTIES	DATA TYPE	DESCRIPTION
ActiveRefTemp	**Integer**	The collection index of the active reference temperature measuring device. The value should be used with the **RefTemp** collection to access the calculation class of the active temperature reference.
AmbPrs	**Calculation Class**	Calculation class of the ambient pressure measuring device.
AmbRH	**Calculation Class**	Calculation class of the ambient humidity measuring device.
AmbTemp	**Calculation Class**	Calculation class of the ambient temperature measuring device.
Auxiliary	**Collection of Calculation Classes**	Collection of **Calculation Classes** used for up to 10 auxiliary data devices. Auxiliary devices are stored in this collection in the order selected during test initialization.
DUTPrs	**Collection of Calculation Class**	Collection of **Calculation Classes** used for each configured DUT. DUTs are stored in this collection in the order selected during test initialization.
MeasModeLP	**Integer**	The test line pressure measurement mode: • 0 – Absolute pressure measurement mode • 1 – Gauge pressure measurement mode. • 2 – Absolute mode by addition of atmosphere.
MeasModePrs	**Integer**	The test pressure measurement mode. See **MeasModeLP**.
Mux1	**Calculation Class**	Calculation class of the test multiplexer. Changing the channel state of the multiplexer is not recommended. The **COMPASS** remote interface triggers remote operation with instruments latched to the multiplexer. Sending a command to change the channel can have an adverse affect on this triggering.
RefLinePrs	**Collection of Calculation Class**	Collection of line pressure reference devices.
RefPrs	**Collection of Calculation Class**	Collection of test pressure reference devices.
RefTemp	**Collection of Calculation Class**	Collection of test temperature reference devices.
SetLinePrs	**Collection of Calculation Class**	Collection of line pressure controllers.
SetPrs	**Collection of Calculation Class**	Collection of test pressure controllers.
SetTemp	**Collection of Calculation Class**	Collection of test temperature controllers.
UnitLP	**Integer**	Test line pressure unit identifier.
UnitPrs	**Integer**	Test pressure unit identifier.
UnitTemp	**Integer**	Test temperature unit identifier.
ValveDriver1	**Calculation Class**	Test valve driver controller.

28.6.2 METHODS

This class has no methods of its own.

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28.7 RANGE CLASS

The Range Class stores information about a specific Output or Set in a device. Refer to the Output Relationship Editor for more detail on the properties of this class (4.3.6.2).

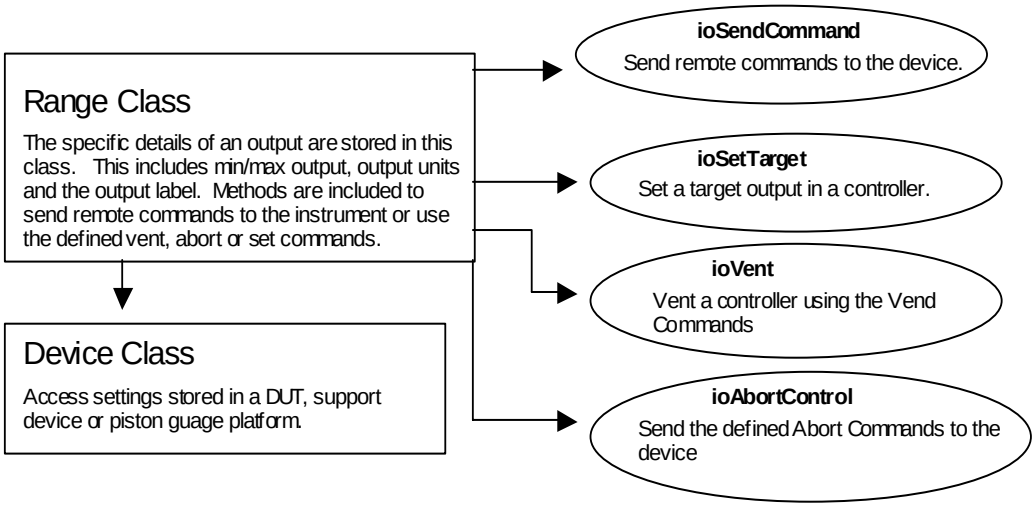
Range Class
The specific details of an output are stored in this class. This includes min/max output, output units and the output label. Methods are included to send remote commands to the instrument or use the defined vent, abort or set commands.
Device Class
Access settings stored in a DUT, support device or piston guage platform.
ioSendCommand
Send remote commands to the device.
ioSetTarget
Set a target output in a controller.
ioVent
Vent a controller using the Vend Commands
ioAbortControl
Send the defined Abort Commands to the device

Figure 208. Range Class Object Model

An asterisk ("*") next to a data type indicates that the property value is read only.

Two asterisks ("**") next to a data type indicate the property is not available in all versions of COMPASS.

28.7.1 PROPERTIES

PROPERTIES	DATA TYPE	DESCRIPTION
AutoGenerate	**Boolean***	TRUE when auto float is active in a PG7000 and FALSE otherwise.
AutoGenerateDeadBand	**Single***	Auto-generation deadband for PG7000 with auto float active.
CommandPrefix	**String**	Command prefix to allow the device to use a passthrough port of another product. **COMPASS** automatically sets this prefix when the device interface uses the COM2 of a **DHI** product.
ControlMode	**Integer***	Pressure control mode of a **DHI** product: • 0 - Static • 1 - Dynamic
cPG	**clPGCalc**	Not available
FactCalDate	**String****	The factory calibration date of **DHI** products.
FactPA	**Double****	Factory adder in Pa.
FactPM	**Double****	Factory multiplier.
FinalOutput	**Double**	The last updated output of the instrument. Setting this property to a new value will automatically trigger the update of any instruments that uses the output.
FinalText	**String***	The user defined text label to associate with the output.

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PROPERTIES	DATA TYPE	DESCRIPTION
HeadHeight	**Single**	The head correction height to use for the device. The value should not be set when a **DHI** device is used.
Hold	**Single**	The output hold limit in the final output unit. The value should not be set when a **DHI** device is used.
InterfaceMode	**Integer**	The interface used to communicate with the device. • 0 - Manual • 1 - Remote • 2 – Support Device
Key	**Long***	Unique database key associated with the Range Class. **DHI** and **COMPASS** manual devices use a randomly generated Key value.
LastResponse	**String***	The last response to the remote command marked for processing.
MaxFinal	**Double**	The full scale output of the device in the final output unit.
MaxRaw	**Double**	The maximum output of the device in the raw output unit.
MeasMode	**Integer**	The pressure measurement mode for pressure controlling and output devices. • 0 - Absolute • 1 - Gauge
MinFinal	**Double**	Minimum final output in the final output unit.
MinRaw	**Double**	Minimum raw output in the raw output unit.
MultiRange	**Boolean***	TRUE for **DHI** products that use multi-ranging and FALSE otherwise.
MultiRangeID	**Integer***	An integer value that represents the RPT or range ID of a multirangeable **DHI** product (PPC2+, RPM3, PPC3, PPCH, RPM4, ect). • For products that support Auto Range, the value is the number of the RPT 1 –n. If the RPT is autoranged, the value is –10. • For products that do not support Auto Range, the value is the range counting up from the lowest range on the Hi RPT: 1 = H1, 2=H2, 3=H3, 4=L1, 5=L2 and 6=L3.
MuxChannel	**Integer**	The multiplexer channel assigned to the device during Test Initialization. If the device is not associated with a multiplexer, -1 is returned.
RangeType	**Integer**	• 0 - Normal output or set. • 1 - **DHI** based output or set. • -1 **DHI** Piston Gauge. • -2 **COMPASS** defined Piston gauge.
RawOutput	**Double**	The last updated raw output value in the raw output unit. Setting a new raw output value automatically updates the calculation of the final output.
RPTSN	**String****	The serial number of the internal RPT of a **DHI** device.
SetDevice	**Boolean**	TRUE when the **Range Class** is used for a set device and FALSE when it is used for an output device.
SpanFinal	**Double***	The span of the final output in the final output unit.
SpanRaw	**Double***	The span of the raw output in the raw output unit.
SS	**Single***	The stability setting in the final output unit of the device. The value should not be set when a **DHI** device is used.

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PROPERTIES	DATA TYPE	DESCRIPTION
TypeFinal	**Integer***	Final output type. • 0 – Pressure • 1 – Temperature • 2 – Voltage • 3 – Current • 4 – Mass • 5 – Rotation • 6 – Other • 7 – Position • 8 – Frequency • 9 – Resistance • 10 – Humidity • 11 - Time • 12 – Multiplexer channel control • 13 – Valve driver channel control
TypeRaw	**Integer***	Raw output type. See **TypeFinal**.
UnitFinal	**Integer**	The unit identifier of the final output unit.
UnitFinal	**Integer***	The unit identifier of the final output.
UnitRaw	**Integer**	The unit identifier of the final output unit.
UnitRaw	**Integer***	The unit identifier of the raw output.
UseAs	**Integer***	The use of the output or set: • 0 – Pressure reference • 1 – DUT pressure • 2 – Test line pressure reference • 3 – Residual vacuum pressure • 5 – Ambient pressure • 6 – Ambient Temperature • 7 – DUT temperature. • 8 – Reference temperature • 9 – Piston-Cylinder temperature • 12 – Ambient humidity • 15 – Piston • 16 – Piston rotation • 17 – Piston fall rate • 18 – Piston rotation decay • 19 – Voltage measurement • 20 – Current measurement • 21 – Frequency measurement • 22 – Resistance measurement • 23 – Auxiliary data device • 43 – Time measurement • 100 – Line pressure controller • 101 – Test pressure controller • 103 – Test temperature controller • 104 – Voltage controller • 105 – Current controller • 108 – Multiplexer • 109 – Valve driver controller

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PROPERTIES	DATA TYPE	DESCRIPTION
UseAutoZ	**Boolean***	TRUE for **DHI** products that are setup to use Auto Zero and FALSE otherwise.
UseMux	**Integer***	Multiplexer channel to that the output is attached to (0 to n) or –1 when a multiplexer is not used.
UserCalDate	**String***	The user calibration date of a **DHI** product.
UserPA	**Double***	The user adder of a **DHI** product.
UserPM	**Double***	The user multiplier of a **DHI** product.
ZNatErrGauge	**Double***	The natural error of a **DHI** product.
ZoffsetAbs	**Double***	The Zoffset in absolute mode of a **DHI** product. The value is not valid for gauge RPTs.
ZoffsetGauge	**Double***	The Zoffset value in gauge mode of a **DHI** product.

28.7.2 METHODS

METHOD	DESCRIPTION
FinalUnit	Text value of the final output unit.
GetParent	Return a reference to the parent **Device Class**.
GetRawFromFinal	Return the raw output corresponding to a given final output.
ioAbortControl	Abort output control for a controller.
IoSendCommand	Send a command to the instrument using the instruments remote interface.
ioSetTarget	Set a new target output for a controller.
IoVent	Vent the output for a controller.
RawUnit	Text value of the raw output unit.

Name **FinalUnit**

Purpose Return the text value of the final output unit.

Syntax `Function FinalUnit()`

Arguments None

Return Value **String**

Remarks Use this function to access the text value associated with the final output unit.

Example None

Name **GetParent**

Purpose Return a reference to the **Device Class** associated with the output or set value used by the **Range Class**.

Syntax `Function GetParent()`

Arguments None

Return Value **Device Class**

Remarks Use this function to access properties in the **Device Class** when it is not directly available in a macro.

Example

```
Function AutoRangeCheck(cRange)

With cRange.GetParent
    Select case .Model
         case "PPC3", "RPM4"
             rtv = "Auto Ranging is Supported"

         case else
             rtv = "Auto Ranging is NOT Supported"

    end select
End with

AutoRangeCheck = Rtv

End Fucntion
```

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Name **GetRawFromFinal**

Purpose Return a raw output when given a final output.

Syntax `Function GetRawFromFinal(dFinalOutput)`

Arguments
- dFinalOutput - Double precision final output value in the final output unit.

Return Value Double

Remarks This function is used to determine raw set values when given a final set value.

Example None

Name **IoAbortControl**

Purpose Abort output control in a device.

Syntax `Function ioAbortControl()`

Arguments None

Return Value TRUE when the abort commands were sent successfully and FALSE otherwise.

Remarks This method can be used only with Range Classes used for pressure or temperature control. The device setup must include abort commands for this method to function properly (see 4.3.7).

Example None

Name **IoSendCommand**

Purpose Send a command using the device interface.

Syntax `Function ioSendCommand(sCmd, bNoResponse, bWaitReply)`

Arguments
- sCmd – The exact command to send.
- bNoResponse – Use TRUE to prevent **COMPASS** from reading a response and FALSE to allow **COMPASS** to read the response.
- bWaitReply - Set this value to TRUE to wait for the instrument to respond prior to exiting the function. In this case, the function return value is the instrument response. Use FALSE to return from the function immediately, even if the instrument has not responded. If bNoResponse is FALSE, **COMPASS** will asynchronously read the response. The value is ignored when bNoResponse is TRUE.

Return Value String value representing the return value of the command. An empty string is automatically returned when bNoResponse is TRUE. If bWaitReply is FALSE, the function will always return an empty string.

Remarks Use this method only when a DH Instruments interface is used to communicate with the device: RS232, HART via RS232, IEEE-488 and TCP/IP.

If the device communications interface is the COM2 port of a **DHI** product, the required COM2 prefix is automatically added to the sCmd value prior to sending the command. The prefix used is stored in the CommandPrefix property of the Range Class**.**

Make sure that the bNoResponse argument is used correctly. Many instruments that send a response will return an error or timeout if the response to a command is not read.

If the return value of the remote command is not required in the macro it is best to set bWaitReply = FALSE. The macro will execute faster. Do not use FALSE for this parameter when the remote command return value is required or if a specific state change is intended by the remote command.

This method supports limited HART functionality in the same way as the ioSendCommand method of the Calculation Class (see 28.8.2). The device used to supply the output must use HART via RS232 as the remote interface selection.

Example None

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Name **ioSetTarget**

Purpose Set a target output in a controlling device.

Syntax `Function ioSetTarget(dTarg1, dTarg2)`

Arguments

- dTarg1 – The first target output
- dTarg2 – The second target output

Return Value TRUE when the commands were sent successfully and FALSE otherwise.

Remarks Use the ioSetOutput method of the of the Calculation Class whenever possible (28.8.2). The ioSetOutput method accesses other instruments as required to set the device output. The ioSetTarget method can be used only with Range Classes used for controlling. Set commands must be specified for the device.

In most cases dTarg1 is a new output value (pressure, temperature, voltage, ect). It must be in the final output unit.

When the class is used for a valve driver, dTarg1 should specify the driver to change and dTarg2 should specify the new state. So dTarg1 = 3 and dTarg2=0 would deactivate valve driver 3.

Example

```
Function Set50PSI(cRange)

If cRange.ioSetTarget(50,0) then
   Set50PSI = TRUE
Else
   Set50PSI = FALSE
End if
```

Name **ioVent**

Purpose Vent the output in a controlling device.

Syntax `Function ioVent()`

Arguments None

Return Value TRUE if the commands were sent correctly and FALE otherwise.

Remarks This method can be used only with Range Classes used for pressure or temperature control. The device setup must include Vent commands for this method to function properly (see 4.3.7).

Example None

Name RawUnit

Purpose Return the text value of the raw output unit.

Syntax `Function RawUnit()`

Arguments None

Return Value String

Remarks Use this function to access the text value associated with the raw output unit.

Example None

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28.8 CALCULATION CLASS

The CalCulation Class is used to control and determine the output of instruments used by **COMPASS**. This class contains a reference to all objects necessary to obtain a single output or control a set for a device. Each Calculation Class is centered around the use of a particular Range Class. This main class is stored in the RangeMain property. The type of output or set provided by the Range Class is the ultimate output of the calculation class. For example, the output provided by the Calculation Class will be DUT pressure when the RangeMain Class UseAs property is 1, DUT Pressure. The Calculation Class uses the final output of all instruments required to obtain the final output of the Range Class. If the raw output source is **<Voltage Measurement>**, the voltage measuring device Range Class will be set to the RangeRaw1 class. Each voltage update is used by the Calculation Class to determine a new output.

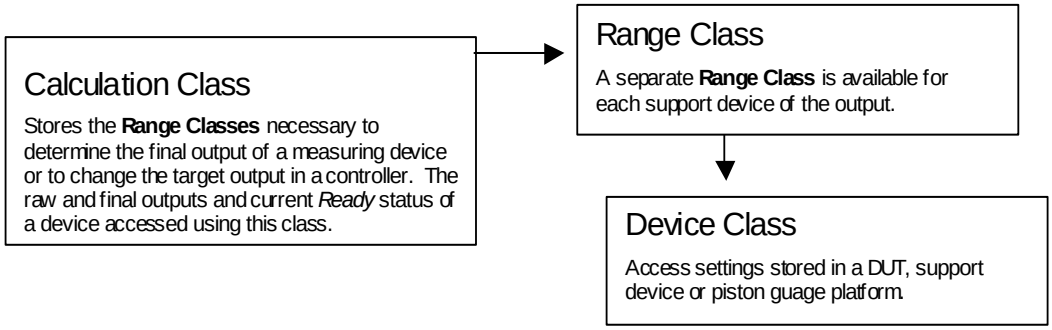
Calculation Class
Stores the Range Classes necessary to determine the final output of a measuring device or to change the target output in a controller. The raw and final outputs and current Ready status of a device accessed using this class.
Range Class
A separate Range Class is available for each support device of the output.
Device Class
Access settings stored in a DUT, support device or piston guage platform.

Figure 209. Calculation Class Object Model

An asterisk ("*") next to a data type indicates that the property value is read only.

28.8.1 PROPERTIES

PROPERTIES	DATA TYPE	DESCRIPTION
AllDataUpdated	**Boolean**	This property returns TRUE when all outputs required by the **Calculation Class** have been updated (Raw Output 1, 2 and 3 when applicable) and FALSE otherwise. This property is checked by **COMPASS** when the **[Tools],[Options],[Run Test] <Wait for update from all remote devices>** option is selected. Set the property to TRUE to prevent **COMPASS** from waiting for an update from a device. This is necessary when a macro is used to alter the way a device output is used.
cDHIClass	**Object***	Object reference to the DH Instruments class specific to a DH Instruments product. Only instruments setup with the **<Auto Detect Setup>** option enabled use this property. The properties events and methods of this object are product specific and are not available at this time.
cDHIClass.SetPressureVolume	**Single**	Read or set the target pressure volume to use for a DHI PPC2+, PPCK+, PPC3 or PPCH pressure controller. Specifying a volume with each new target pressure is necessary to improve control performance in some cases. By default the value is invalid, -9999. If a value greater than 0 is set to this property, each new target pressure request to the PPC will use the command format "PS= Target,Volume". The default format is "PS=Target".
DHIDevice	**Boolean***	TRUE when the device is setup to use the **<Auto Detect Setup>** flag.
dspForm	**Form***	The object reference to the display form used for the output.

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PROPERTIES	DATA TYPE	DESCRIPTION
ErrorFS	**Single**	The last updated %Full scale error.
ErrorRdg	**Single**	The last updated %Reading error.
ErrorSpan	**Single**	The last updated %Span error.
FinalOutput	**Double**	The last updated final output value in the final output unit.
inTolerance	**Integer**	The tolerance state based on the current output. All applicable tolerance segment criteria are applied. TRUE – The output is in tolerance. FALSE – The output is out of tolerance. -9999 – There is no tolerance specification
Obj1	**Object**	Read or set an object used by macro. Use this property to store a reference to an object used by a macro. A "Set" statement is required to assign an object to this property. The reference will persist until the test is aborted or other macro code removes the reference. **COMPASS** does not directly access this property.
Obj2	**Object**	See **Obj2**.
Obj3	**Object**	See **Obj3**.
Obj4	**Object**	See **Obj4**.
OverRangeLimit	**Single**	A multiplier applied to the maximum final output to indicate the maximum output value **COMPASS** will attempt to set with the device. By default 10% over the maximum full scale value is used. This corresponds to 1.1. To allow double the full scale output set this property to 2. Any target output that exceeds the limit is automatically issued at the limiting value. See the ioSetOutput method.
RangeMain	**Range Class***	The primary device output or set used by the Calculation Class. The other Range Classes are in support of this class. The UseAs property of this class determines how the Calculation Class will be used.
RangeRaw1	**Range Class***	The Range Class of the instrument used to provide the first raw output value when the RangeMain class requires a support device. If a support device is not used for the first raw output in the **Output Relationship Editor**, this property should not be used. When the RangeMain class is for a non **DHI** piston gauge, this class represents the piston-cylinder temperature measuring device output specified during test initialization.
RangeRaw2	**Range Class***	The Range Class of the instrument used to provide the second raw output value when at least 2 raw outputs were specified in the **Output Relationship Editor**. When the RangeMain class is for a non **DHI** piston gauge, this class represents the piston position measuring device output specified during test initialization.
RangeRaw3	**Range Class***	The Range Class of the instrument used to provide the third raw output value when at least 3 raw outputs were specified in the **Output Relationship Editor**. When the RangeMain class is for a non **DHI** piston gauge, this class represents the piston rotation rate measuring device output specified during test initialization.
RangeRaw4	**Range Class***	The **Range Class** of the instrument used to read the DUT temperature when the RangeMain class is a DUT and a DUT measuring device was selected during test initialization (7.3.3). When the RangeMain class is for a non **DHI** piston gauge, this class represents the reference vacuum measuring device output specified during test initialization.

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PROPERTIES	DATA TYPE	DESCRIPTION
RawOutput1	**Double**	The output of the instrument setup to provide the first raw output value. Changing this property value automatically triggers a new calculation update. Only set this property to a value that is already in the proper unit of measure. To avoid setting the value in the same unit of measure use the **RangeMain** or the **RangeRaw1** classes and set their **RawOutput** property to the desired value. The normal unit conversions between the output source device's final output unit of measure and the requested raw output unit of measure happen automatically. When the RangeMain class is for a non **DHI** piston gauge, this value represents the piston-cylinder temperature measuring device output specified during test initialization
RawOutput2	**Double**	The output of the instrument setup to provide the second raw output value when at least 2 raw outputs were specified in the **Output Relationship Editor**. Only set this property to a value that is already in the proper unit of measure. To avoid setting the value in the same unit of measure use the **RangeRaw2** class and set the **RawOutput** property to the desired value. The normal unit conversions between the output source device's final output unit of measure and the requested raw output unit of measure happen automatically. When the RangeMain class is for a non **DHI** piston gauge, this value represents the piston position measuring device output specified during test initialization.
RawOutput3	**Double**	The output of the instrument setup to provide the third raw output value when at least 3 raw outputs were specified in the **Output Relationship Editor**. Only set this property to a value that is already in the proper unit of measure. To avoid setting the value in the same unit of measure use the **RangeRaw3** class and set the **RawOutput** property to the desired value. The normal unit conversions between the output source device's final output unit of measure and the requested raw output unit of measure happen automatically. When the RangeMain class is for a non **DHI** piston gauge, this output represents the reference vacuum measuring device output specified during test initialization.
RawOutput4	**Double**	The output of the instrument used to read the DUT temperature when the RangeMain class is a DUT and a DUT measuring device was selected during test initialization (7.3.3). Only set this property to a value that is already in the proper unit of measure. To avoid setting the value in the same unit of measure use the **RangeRaw4** class and set the **RawOutput** property to the desired value. The normal unit conversions between the output source device's final output unit of measure and the requested raw output unit of measure happen automatically. When the RangeMain class is for a non **DHI** piston gauge, this output represents the reference vacuum measuring device output specified during test initialization.
Ready	**Boolean**	TRUE when a controlled output is ready based on the **COMPASS** stability criterion or the instruments remotely queried ready criterion. A remotely queried ready criterion is available on when Ready Commands are specified for the device (4.3.7).
RefOutput	**Double**	The last updated reference final output for DUT based Calculation Classes. The value is always in the final output unit of the reference.
RegEnabled	**Boolean***	TRUE when output regulation is enabled and FALSE otherwise.

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PROPERTIES	DATA TYPE	DESCRIPTION
RegulationMode	**Integer***	The type of output regulation: • 0 - No Regulation • 1 - Regulate to the reference output • 2 - Regulate to the DUT output
RegulationTime	**Integer**	The time interval in seconds between output regulation updates.
Target	**Double***	The last set target output.
ToleranceValue	**Double***	The tolerance value in the final output unit associated with the current final output. The value is –9999 when no tolerance is specified.

28.8.2 METHODS

METHOD	DESCRIPTION
CalcErrors	Trigger an update to the error calculation.
GetParamData	Read one of up to 20 double precision values set by a macro.
ioSendCommand	Send a command using the device interface.
ioSetOutput	Set a net target output in a controlling device.
ManualOutputUpdate	Trigger a new output calculation given all necessary raw output data.
SetOutputRegulation	Change the state of the current output regulation. Used for controllers only.
SetParamData	Set one of up to 20 double precision values available for use in macros.

Name **CalcErrors**

Purpose Force a new error calculation of existing reference and DUT data or reference and DUT data passed as arguments.

Syntax `sub CalcErrors([dDUT], [dReference])`

Arguments
- dDUT – Optional double precision DUT final output value. If a value is not specified, the current final output is used. This argument does not change the current DUT final output.
- dReference – Optional double precision reference final output value. This value must be in the DUTs final output unit. This argument does not change the current reference final output.

Return Value None

Remarks Only DUTs should use this method. This function is used to determine errors with data passed to the class or data currently stored in the class. The error data is available in the applicable error related properties.

The error values set are not necessarily used by **COMPASS** when taking data. **COMPASS** always calls this method with the current DUT and reference output **prior** to logging a point. If the outputs are different, new errors will be used.

Example None

Name **GetParamData**

Purpose Read one of 20 double precision values stored in the class by using a **COMPASS** macro.

Syntax `Function GetParamData(iID)`

Arguments
- iID – The integer index of the parameter to read. The value can be 0 to 20.

Return Value Double precision parameter value.

Remarks This data space is made available to macros to allow data to persist between macro calls. The data must be set using the SetParamData method. Any desired data can be added to these 20 fields: flags, intermediate calculation variables, etc.

Example None

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Name **IoSendCommand**

Purpose Send a command to the device supporting any of the Range Classes maintained by the Calculation Class.

Syntax `Function ioSendCommand(sCmd, bNoResponse, [iSendTo])`

Arguments

- sCmd – The exact command to send. Special formatting is possible to send commands to a HART instrument (see Remarks)
- bNoResponse – Use TRUE to prevent **COMPASS** from reading a response and FALSE to allow **COMPASS** to read the response.
- iSendTo – Optional integer indicating which Range Class to use to send the command.
  - 0 – **RangeMain**
  - 1 – **RangeRaw1**
  - 2 – **RangeRaw2**
  - 3 – **RangeRaw3**
  - 4 – **RangeRaw4**
  - 5 – **RangeRaw5**

Return Value String value representing the return value of the command. An empty string is automatically returned when bNoResponse is TRUE.

Remarks Use this method only when a DH Instruments interface is used to communicate with the device: RS232, HART via RS232, IEEE-488 and TCP/IP. This function is simply calls the ioSendComand of the appropriate Range Class (28.7.2).

Remote commands can be sent to an instrument for any reason desired. Data can be read from the instrument and stored in the class. For example, calibration information of a device can be read by using this method. The data retuned can then be set to the Device Class CalInfo properties. If the macro is called using a Pre-Test Macro selected in the Test Definition, the data will be stored in the data file and available in reports as well as other macros.

Special functionality is provided for devices that use a HART interface (see 25.5, HART via RS232). A thorough understanding of the HART command structure is required to use this functionality. HART commands can be used by formatting the sCmd parameter in a specific way. There are 2 methods, 1 for COMPASS supported HART commands and a second for non COMPASS supported HART commands. COMPASS supports the following Universal and Common Practice HART commands: 0,1,2,3,8,14,15,40,45, and 46. The format for any of these commands is colon delimited as follows:

"HART:cmd #:Parameter1:Parameter2"

For example, read the loop current by sending Universal Command 2, "HART:2:0:0". The return value is the formatted HART response comma delimited, "16.234 mA, 76.234%".

Non COMPASS supported HART commands must specify not only the command but also the command bytes to send and the discrete decimal value of each of the data bytes to pass to the remote device. COMPASS formats this information along with the command preamble, delimiter, unique address and check sum to create the final HART command. These commands are formatted as follows:

"HART BYTES:cmd #:BYTES=#:BYTE1:BYTE2:BYTE3:BYTE4:ect…"

A discrete colon delimited byte value is required for the number of bytes specified by the "BYTES=#" field. For example, to set the primary variable unit of measure to kPa (HART unit code 12) use command 44, "HART BYTES:44:1:12". The return value is not formatted as in the case for supported HART commands. A comma delimited string containing all data bytes in the response following the HART command number is returned. The data bytes are in decimal format. Use the VB Script functions **split** or the **Global Macro** function **qextract** to remove the individual decimal values from the string.

Example This example demonstrates how to send use the ioSendCommand method to communicate with the active reference device. In this case the reference is a PPC3 and the command will set a target pressure with a volume argument. The reference Calculation Class is accessed by using the Configuration Class in the global COMPASS Class. Since the COMPASS Class is global, this code can be used in any macro function.

```
With cCOMPASS.cConfig.RefPrs(1)
     Reply = .ioSendCommand("PS=100,75", FALSE, 0)
End With
```


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Name **IoSetOutput**

Purpose Control the output of an instrument using the configured command and control settings.

Arguments

- dTarg1 – The first target output
- dTarg2 – The second target output
- iOutputType – The type of output to send to an instrument.
  - 0 – Primary target output: pressure, temperature, driver channel
  - 1 – Vent the instrument using the vent commands
  - 2 – Abort control using the abort commands.
  - 6 – Set the pressure faster with less control for a **DHI** product only. The PSF command is used.
  - 7 – Change the state of the Up Fast valve of a PPC. dTarg1 is 0 to close the valve and any other value to open the valve. The valve must be closed after it is opened to prevent pressure from continually increasing.
  - 8 – Change the state of the Down Fast valve of a PPC. dTarg1 is 0 to close the valve and any other value to open the valve. The valve must be closed after it is opened to prevent pressure from continually decreasing.\

Return Value TRUE when the output was set successfully and FALSE otherwise.

Remarks This method can be used only when the RangeMain Range Class is used for controlling. The interface or instrument required to set an output is used to set the desired output. For example, if a voltage controlled regulator is issued a target pressure, the configured voltage supply instrument selected during test initialization will be sent a command to set a voltage equivalent to the target pressure. When a direct remote command interface with the instrument is available, the target remote commands are sent to the instrument.

The OverRangeLimit multiplier property is used to limit how far beyond the maximum final output a target output may be. This limit is enforced only when the iOutputType argument is 0.

In most cases dTarg1 is a new output value (pressure, temperature, voltage, ect). It must be in the final output unit of the RangeMain Range Class.

When the class is used for a valve driver, dTarg1 should specify the driver to change and dTarg2 should specify the new state. So dTarg1 = 3 and dTarg2=0 would deactivate valve driver 3.

Example This example demonstrates how pressure can be set in two stages with a PPC by using this Method. This scheme may be necessary to set pressure faster when a large volume is used in the test system.

```
'Set Pressure fast to 95 psi
b = cCalc.ioSetOutput(95, 1, 6)

Delay 45

'Set 100 psi with using the normal pressure
b = cCalc.ioSetOutput(100, 1, 0)
```

Name **ManualOutputUpdate**

Purpose Manual set the raw output information for an instrument.

Syntax `Sub ManualOutputUpdate([dRaw1], [dRaw2], [dRaw3], [dRaw4])`

Arguments

- dRaw1 – Optional double precision value representing the first raw output of an instrument.
- dRaw2 – Optional double precision value representing the second raw output of an instrument.
- dRaw3 – Optional double precision value representing the third raw output of an instrument.

Return Value None

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Remarks This method automatically updates the output information of a measuring device in **COMPASS**. When a required calculation argument is not passed to the method, **COMPASS** will use the most recent data average if available, otherwise the last instantaneous output is used.

This method should be used to automatically update the output of an otherwise manual device. All errors and corresponding final output information is updated in the class.

Example None

Name **SetOutputRegulation**

Purpose Enable or disable output regulation in controlling instruments.

Syntax `Sub SetOutputRegulation(iMode, iTime)`

Arguments

- iMode – An integer representing the type of output regulation.
  - 0 – Disable regulation
  - 1 – Regulate to the reference output.
  - 2 – Regulate to the DUT output. Only possible when used with the test pressure controller.
- iTime – The time interval in seconds between regulation updates.

Return Value None

Remarks Regulation is the process that **COMPASS** uses to automatically adjust the output of an instrument to achieve a specific set point in a DUT or reference. The output is automatically adjusted at time intervals based on the iTime argument (3.3.5.1).

Any manual entry or manually controlled instrument cannot be used in association with output regulation.

This function changes the state of the RegulationMode and RegulationTime properties.

Example None

Name **SetParamData**

Purpose Set one of 20 double precision values stored in the class by using a **COMPASS** macro.

Syntax `Sub SetParamData(iID, dData)`

Arguments

- iID – The integer index of the parameter to read. The value can be 0 to 20.
- dData – The double precision value to store in the class.

Return Value None

Remarks This data space is made available to macros to allow data to persist between macro calls. The data can be read using the GetParamData method. Any desired data can be added to these 20 fields: flags, intermediate calculation variables, etc.

Example None

28.9 COMPASS CLASS

The **COMPASS Class** is the only global object supplied by **COMPASS** within a macro. All macro types can access the properties and methods of the **COMPASS Class** at any time. The object is named "**cCOMPASS"**. Just enter this object name followed by an appropriate property or method: c**COMPASS**.StatusDisplay "Hello World". No special declaration is required. Like all objects used in a macro, the **COMPASS Class** is not accessible in the **<Debug Window>** on the **COMPASS Macro Editor** (see 18.3).

The **COMPASS Class** contains a reference to the **Configuration Class**, a reference to the active **Test Class**, and many properties that are useful when automating **COMPASS**. Use this object to monitor the state of **COMPASS**, access data that is otherwise not available in a macro function, and to update the status bar with information in a macro.

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One of the most important uses of the **COMPASS Class** is to pass program thread control back to the main **COMPASS** program within a macro by using the **TimeDelay** function. This function is required to support asynchronous operation with **COMPASS** and a macro. If this function is not used, **COMPASS** code will not run until the macro completes. This means the devices used with **COMPASS** and their corresponding Run Windows will not update with new output data. A small occasional delay is all that is necessary to prevent this problem (see **Threading Model**, 18.6).

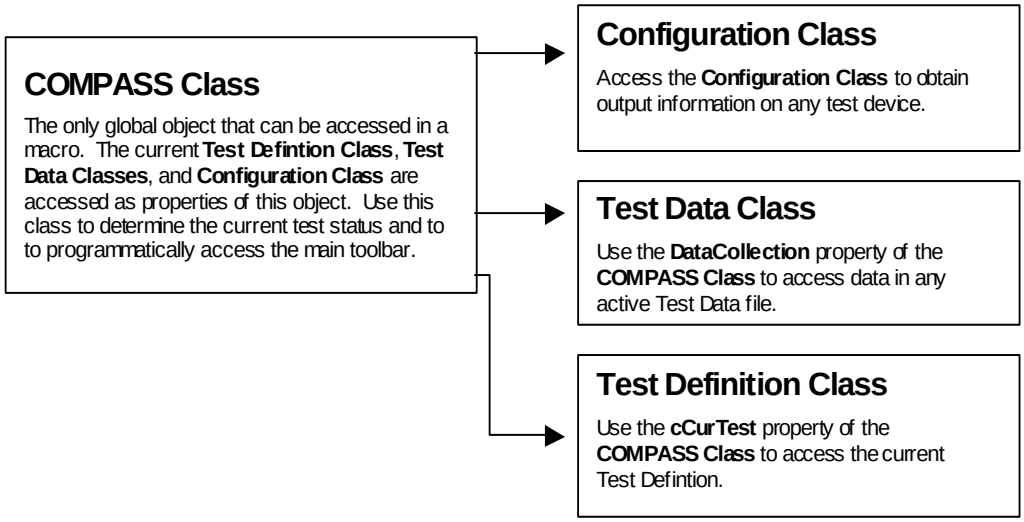
COMPASS Class
The only global object that can be accessed in a macro. The current Test Defintion Class, Test Data Classes, and Configuration Class are accessed as properties of this object. Use this class to determine the current test status and to to programmatically access the main toolbar.
Configuration Class
Access the Configuration Class to obtain output information on any test device.
Test Data Class
Use the DataCollection property of the COMPASS Class to access data in any active Test Data file.
Test Definition Class
Use the cCurTest property of the COMPASS Class to access the current Test Defintion.

Figure 210. COMPASS Class Object Model

28.9.1 PROPERTIES

PROPERTIES	DATA TYPE	DESCRIPTION
cConfig	**Configuration Class**	The property holds a reference to the current **Configuration Class** (see 28.6). Uses this property when a macro function does not include the desired data as one of its parameters. `AmbP = cCOMPASS.cConfig.AmbPrs.FinalOutput`
cCurTest	**Test Definition Class***	The current **Test Definition Class** when a Test Definition is running. Use this class to change test specific properties. If desired, the test dwell time can be changed for each point or based on test conditions within a pre-point macro. For example: `cCOMPASS.cCurTest.TestPrsDwellTime = 500`

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PROPERTIES	DATA TYPE	DESCRIPTION
CurrentTestStep	**Integer**	This property determines the current step in a test. Although it can be used in any way desired, it is intended to work with Test Event macros. By checking the value of this property a Test Event macro can take specific actions during a test. When running a manual test, the value is always 0. The list below contains all possible values of this property. Each of the property changes to the listed value before the listed action actually begins. • **0** -Undefined • **100** - Set Temperature • **110**- Temperature Dwell • **150**- Temperature Cycle Complete. All line pressure and pressure cycle points are complete and recorded. • **200**- Set Line Pressure • **210**- Line Pressure Dwell • **250**- Line Pressure Cycle Complete. All pressure cycle and pressure points are recorded. • **300**- Set Test Pressure • **310**- Test Pressure Dwell • **320**- Averaging test pressure • **330**- Averaging complete. The averaged data is logged. • **400**- Pre-Test Leak Test • **500**- Pre-Test Pressure Cycle (Exercise) • **1000**- New Test Cycle. A new test file is being created for each DUT. No data has been collected. • **1050**-Test Cycle Complete. All points defined in a test have been logged. • **1100**- New Test Pressure Cycle • **1150**- Test Pressure Cycle Complete. All pressure points defined in a pressure cycle have been logged. The system has not been vented. • **2000**-Test Complete. The post test options have not displayed and the user notes have not been entered.
DataCollection	**Collection**	A collection of **Test Data Classes** that can be used to verify and manipulate data collected during a test (see 28.2). If data is changed by using this object, the resultant data file data is not changed until the test or current pressure cycle is complete. At the end of every test, **COMPASS** rebuilds all data files to insure that repeated test points are not logged in the final data file.
MainForm	**MDI Form**	The property holds a reference to the main MDI Form within **COMPASS**.
Options	**Object**	All options specified in **[Tools]**,**[Options]** can be accessed by using this object. The properties and methods of this object are not available.
PauseState	**Boolean**	Read or set the current program paused state. If the value is set to TRUE the current test is paused in the same way as the **[Pause]** toolbar button works. If **COMPASS** is paused, it must be un-paused to continue.

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PROPERTIES	DATA TYPE	DESCRIPTION
RunMode	**Intetger**	Holds the current **COMPASS** run state. Use the property to make decisions in a macro that are related to the way **COMPASS** is running a test. The value cannot be changed within a macro. The property has the following values: • 0- Idle, **COMPASS** is not running a test. • 1- Run Test is active • 2- Run Manual Test is active.
SystemAbort	**Boolean**	Read the current test abort flag. If the value is TRUE, the active macro code must exit immediately. If it does not, **COMPASS** will "hang" while trying to abort a test. The property should be checked when a macro will execute loops that will take an indefinite amount of time. To abort a test use the **AbortTest** method.

28.9.2 METHODS

METHOD	DESCRIPTION
AbortAutoPointCollection	Programmatically press the **[Abort Autopoint Collection]** toolbar button (see 5.4.3). This stops all active automatic point collection if it is active. Use the **TakePoints** method to enable automatic point collection.
AbortTest	Programmatically press the **[Abort]** button on the main toolbar. There is an option abort immediately without a prompt.
CurrentPoint	Read the current test point information when running a test definition.
OpenNewDataFile	Programmatically press the **[Open File]** toolbar button. Use the **COMPASS** default naming convention to avoid the file name, common dialog box from displaying (see **[Data File] Tab**, 14.8). This option can be used with Manual Tests only.
StatusDisplay	Change the text displayed on the **COMPASS** status bar (see 5.3). This is a useful way to debug macros and monitor the progress of a macro during a test.
StepBack	Programmatically press the **[Step Back]** button. Just like the button on the toolbar, this method must be called multiple times to step back through the various steps in test (see **Run test Tools,** 5.4.1).
StepNext	Programmatically press the **[Step Next]** button. Just like the button on the toolbar, this method must be called multiple times to step skip through the various steps in test (see **Run test Tools,** 5.4.1) .
TakePoints	Programmatically press one of the Manual Test data acquisition buttons. The arguments to the method determine which button is pressed (see **Data Acquisition Tools**, 5.4.3).
TimeDelay	Asynchronously delay the execution of a macro. All other events in **COMPASS** will remain active, however the current macro will delay for the time given as a parameter to this function. If a macro uses an indefinite loop or a loop that will typically take several seconds, the method should be called with a very small time delay (0.5) to allow an update of events within **COMPASS**. In general,

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Name **AbortAutoPointCollection**

Purpose Programmatically press the **[Abort Autopoint Collection]** toolbar button (see 5.4.3). This stops all active automatic point collection if it is active. Use the **TakePoints** method to enable automatic point collection.

Syntax c**COMPASS**.AbortAutoPointCollection

Arguments None

Return Value None

Remarks Use this method to abort automatic point collection when running a manual test in **COMPASS**. Automatic point collection can be setup by user interaction or the **TakePoints** method.

Example See **TakePoint** example.

Name **AbortTest**

Purpose Programmatically press the **[Abort]** button on the main toolbar to abort any active test.

Syntax rtv = c**COMPASS**.AbortTest(bSilentAbort)

Arguments

- bSilentAbort – Use TRUE to abort the active test without a prompt to the user. Use FALSE to abort the test only if the current test users responds appropriately.

Return Value Boolean value that is TRUE if the test is aborted and FALSE otherwise.

Remarks Always use TRUE for the bSilentAbort parameter if a user will not be present when the macro aborts the program. Otherwise **COMPASS** will hang waiting for a response to the abort test prompt. A macro may need to abort the test if there is an error or of the necessary data has already been collected.

Example None

Name **CurrentPoint**

Purpose Read the current test point information when running a test definition.

Syntax c**COMPASS**.CurrentPoint iT, iL, iPC, iP

Arguments

- iT - The current test temperature point.
- iL - The current test line pressure point.
- IPC - The current test pressure cycle.
- iP - The current test pressure point.

Return Value None

Remarks This function can be used with a manual test. In this case, the only value that will change is the iP parameter. It will increment for each test point logged. All other parameters will return 0.

This function cannot be used to set the current test point. The only way to navigate between points in a test is to use the **StepBack** and **StepNext** methods of the **COMPASS** object.

Example None

Name **OpenNewDataFile**

Purpose Programmatically press the **[Open File]** toolbar button to log data when running a Manual Test (see **Data Acquisition Tools**, 5.4.3).

Syntax c**COMPASS**.OpenNewDataFile

Arguments None

Return Value None

Remarks Always use the **COMPASS** default naming convention to avoid the file name, common dialog box from displaying (see **[Data File] Tab**, 14.8). If this option is not selected, a test user must select the file name and location of the new data file.

Never use this method when running a Test Definition.

Example None

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Name **StatusDisplay**

Purpose Change the text displayed on the **COMPASS** status bar (see 5.3). This is a useful way to debug macros and monitor the progress of a macro during a test.

Syntax c**COMPASS**.StatusDisplayAbortTest Msg

Arguments

- sMsg – The text to display on the **COMPASS** status bar.

Return Value None

Remarks Use this method within a macro to notify **COMPASS** users of the current macro operation. Even when the macro task is relatively small, it is good practice to keep users updated.

Limit the text passed in the sMsg parameter. The statusbar can only display 1 line of data at a time and has a limited with. Use sentence fragments that include only relevant information.

When running a Test Definition, there are many test based status messages that display. In some cases, these messages will overwrite the current macro status message. It depends on the macro type used to generate the status message. Typically messages created within a **Test Macro** are not interrupted. However a status message created within a **Relationship Macro** will be interrupted.

The status bar is not systematically updated when running Manual Tests. Therefore most status messages will remain on the status bar indefinitely. Make sure the status bar is cleared by using "" as the sMsg parameter. To manually clear the status bar, double-click the text.

Example This example will display the text "Hello World" on the **COMPASS** status bar.

```
cCOMPASS.StatusDisplay "Hello World"
```

Name **StepBack**

Purpose Programmatically press the **[Step Back]** button.

Syntax c**COMPASS**.StepNext

Arguments None

Return Value None

Remarks Unlike the button on the toolbar, each call to this method moves the current test point back by 1 (see **Run test Tools,** 5.4.1). The individual test steps are skipped.

In many cases it is desirable to repeat a test point if the controller or piston gauge was not ready while averaging or if the DUT is out of tolerance. These cases are automatically handled by **COMPASS** options (see **[Run Test] Tab**, 14.4).

This method should never be used when a Manual Test is running. Check the **RunMode** property of the **COMPASS Class** to verify the current test type if necessary.

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Example This example demonstrates how to repeat a test point. The macro is designed to automatically repeat test points that do not repeat within 50% of their tolerance specification. It requires a test with multiple test pressure cycles and a DUT with a valid tolerance specification. Each point in the test must use this macro as the pre-point macro (see **Custom Point Operations**, 8.6.3).

After the first pressure cycle is complete, the macro will compare the error of the current point on the current pressure cycle to the same point on the first pressure cycle. If the change in error exceeds 50% of the tolerance the point is repeated. Since this is a pre-point macro, the previous data point is actually tested. The current data point is not valid before the point is set.

```
'module level variable
DIM RepeatPoint   'The point that was last repeated
DIM RepeatCount   'The number of repeats for that point

'**************************************
'Check test points for out of tolerance data.
'If this occurs, automatically repeat the points
'up to 2 times.
'the test or device collection as desired.
'iT  The current temperature point in the test
'iL  The current line pressure point in the test.
'iC  The current pressure cycle in the test.
'IP  The current pressure point in the test.
'cTest   The test class .
'cConfig  Configuration class that holds all active devices.
'
'**************************************
Function Test22445(iT, iL, iC, iP, cTest, cConfig)

Limit = 0.5  'Limit Relative tolerance

if iP <= 1 or iC <=1 or (RepeatCount >= 2 and iP = RepeatPoint) then
   'No points have been repeated
   RepeatCount = 0
   Exit Function

else

    if iP <> RepeatPoint then RepeatCount = 0  'Clear repeat flag

    cCOMPASS.StatusDisplay "Verifying data repeatability"

    'Since this is a Pre-Point macro, the current
    'point doesn't have data yet, so the previous
    'point is checked
    With cCOMPASS.DataCollection(1).DataPointRef(1, 1, 1, cint(iP - 1))
       Diff1 = .DUTDiff
    End With

    With cCOMPASS.DataCollection(1).DataPointRef(1, 1, cint(iC), cint(iP - 1))
       Diff2 = .DUTDiff
       tol = abs(.Tolerance)  'tolerance value
    End With

    RepVal = abs(Diff1 - Diff2)

    '***Uncomment the message lines to view messages
    '***for debugging
    'msg = "DIFF1: " & diff1 & vbcrlf & "DIFF2:" & diff2
    'msg = msg & vbcrlf & "TOL:" & TOl & vbcrlf
    'msg = msg & "Difference:" & repVal
    'msgbox msg, vbSystemModal, "POINT:" & iP & "  CY:" & iC

    if RepVal > (Limit * Tol) then
       'The value did not repeat
       'within the desired specification

       RepeatCount = RepeatCount + 1
       RepeatPoint = iP    'Flag repeated point

       cCOMPASS.StatusDisplay "Repeating Test Point"
       cCOMPASS.StepBack


    end if

end if


End Function
```


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Name **StepNext**

Purpose Programmatically press the **[Step Next]** button to skip through steps or points in a test.

Syntax c**COMPASS**.StepBack

Arguments None

Return Value None

Remarks Unlike the **StepBack** method, **StepNext** has the identical function as the button on the toolbar; each call to this method increments the current test step (see **Run test Tools,** 5.4.1). There are 3 test steps: set pressure, dwell and data acquisition. In a pre point macro, the current test step is set pressure. One call to **StepNext** will skip pressure generation and continue with the test dwell. A second call will skip the dwell and resume operation with data acquisition. If called a third time, test operation resumes with the set pressure step of the next test point. This process will continue up to the data acquisition step of the first point following the maximum test point completed.

Example See **StepBack**

Name **TakePoints**

Purpose Programmatically press one of the Manual Test data acquisition buttons to collect data within a macro (see **Data Acquisition Tools**, 5.4.3) .

Syntax c**COMPASS**.TakePoints iMode, iAvgTime, lInterval

Arguments

- iMode – Integer value that represents the individual take point button to press:
  - 0 - Single point
  - 1 – Average then take a point
  - 2 – Individual points at an interval
  - 3 – Averaged points at an interval
- iAvgTime – Integer value that represents the averaging time in seconds. The value is used only when iMode is 1 or 3. Manual averaging is not supported by this function
- lInterval – Long integer that represents the interval between collected data points. The value is used only when iMode is 2 or 3.

Return Value None

Remarks This function can be used only when running a manual test with a valid data file open. The data file can be opened by clicking the **[Create Data File]** button on the toolbar or by calling the **OpenNewDataFile** function in a macro (see **Data Acquisition Tools**,5.4.3).

When interval based data acquisition is used (iMode = 2 or 3), the user or the macro must abort data acquisition by clicking the **[Abort Auto Point]** button on the toolbar or by calling the **AbortAutoPointCollection** method. Data collection is automatically aborted when the test ends.

Using any of the automatic data logging options can result in very large Data Files. These are files with significantly greater than 1000 data points. COMPASS was not intended to manipulate such files. Lower performance PC's will experience significant delays in generating reports and plots of large Data Files. Therefore, use of the plotting and reporting functions with very large Data Files is not recommended. Instead, export the Data File to a spread sheet application for further analysis.

Use the **DataCollection** property to manipulate data and open data files. When a point is collected, it will remain in the data file regardless of any property changes in the **Test Data Class**.

COMPASS options that can automatically repeat points are not used when running a manual test (see **[Run Test] Tab**, 14.4).

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Example This example demonstrates how to collect test data based on the output of a device. In this example assume that the function below is called as part of the relationship macro of a pressure switch type DUT. Each new output for the DUT will call this macro code. The idea is to log the pressure at which the DUT transitions from open to closed. If a manual test is executed, a test operator must change the test pressure force data to be logged.

```
'**************************************
'Return the pressure as 100pis or 0
'depending out the output value
'
'Out1     :By default, this is the raw formatted, output of a
'          device.  In other cases, it is final output of a
'          test configured device in the configured output unit.
'Out2     :Final output of a test configured device in the
'          configured output unit.
'Out3     :Final output of a test configured device in the
'          configured output unit.
'ParamID  :Parameter ID of the device .
'cCalc    :Device Calculation Class that the relation ship applies to.
'
'The value is returned by setting the function name =
'to the calculated value..
'
'For example: Relationship51602 = 1 / Out1^.5
'**************************************
Function PressureSwitch(Out1, Out2, Out3, ParamID, cCalc)

If Out1 > 4.9 then
    'The switch is Open
    rtv = 100

    if cCalc.FinalOutput = 0 then
        'A transition occurred so log a point
        'Force the proper output first
        cCalc.FinalOutput = 100
        cCOMPASS.TakePoints 0, 0, 0
    end if
Else
    rtv = 0

    if cCalc.FinalOutput = 100 then
        'A transition occurred so log a point
        'Force the proper output first
        cCalc.FinalOutput = 0
        cCOMPASS.TakePoints 0, 0, 0
    end if

End if

PressureSwitch = rtv

End Function
```

Name **TimeDelay**

Purpose Suspend macro operation for a user specified amount of time.

Syntax `cCOMPASS.TimeDelay fDelay`

Arguments

- fDelay – Single precision number that represents the amount of time in seconds to delay.

Return Value None

Remarks It is important to use this function when a macro is executing an indefinite loop or when the macro execution is based on the change in output of a device used by **COMPASS** (see **Threading Model**, 18.6).

Actual delay time compared to the fDelay parameter is a function of computer performance and the number of total devices used by **COMPASS**. There is no recommended method within **COMPASS** or a macro to accurately delay for a specified amount of time.

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Example This example demonstrates how to force data collection when running a test. It is similar to the **TakePoint** example. The macro effectively intercepts the test dwell test step and waits for a DUT to transition from closed to open. At this point, the actual test dwell step is skipped by using the **StepNext** method, and the test continues with data acquisition. It is assumed that the DUT is considered open when the DUT pressure is 100 psi and that the target pressure results in a relatively slow pressure ramp. The macro is selected as the Test Event Macro in an Advanced Test (see 8.7, **[Data] Tab**).

```
'*************************************************************
'Test Macro do not have a return value.  Manipulate
'the test or device collection as desired.
'iT  The current temperature point in the test
'iL  The current line pressure point in the test.
'iC  The current pressure cycle in the test.
'IP  The current pressure point in the test.
'cTest   The test class .
'cConfig  Configuration class that holds all active devices.
'
'*************************************************************
Function InterCeptDwell(iT, iL, iC, iP, cTest, cConfig)

'Only check test dwell test steps
If cCOMPASS.CurrentStep <> 310 then exit function

T1 = timer  'Log starting loop time
cCOMPASS.StatusDisplay "Waiting for DUT Transition.."

Do
   cCOMPASS.TimeDelay .1   'Allow COMPASS Events

   if cCONFIG.DUT(1).FinalOutput = 100 then
       'The DUT has transitioned so escape..
       cCOMPASS.StepNext  'Move to data acquisition
       exit do
   end if

'Use global function to check the time from
'start of loop.  Timeout after 200s to prevent
'infinite loop
Loop until Time_Difference(T1) > 200


End Function
```

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29. CALCULATIONS

COMPASS operation includes many internal calculations. Most of these calculations are related to analyzing the data taken during a test run. The internal calculations performed by **COMPASS** are documented in the sections that follow. The calculations have been verified both by comparison of the program code content to the defined formulas and by parallel manual calculation.

All unit conversions and associated calculations are performed by the Unit of Measure Converter Use this tool to verify unit conversions as necessary.

29.1 ERRORS

The DUT error expresses the difference between the DUT reading and the reference reading at a particular point in a test.

Errors are calculated in four different ways: %Reading, %DUTFS, %Reading Set Point, and %DUTFS Set point.

%Reading and %DUTFS errors express the difference between the DUT output and the reference output or the DUT span. The %Reading Set Point and %DUTFS Set Point options express the difference between the reference output and the set point or the DUT span.

%Reading errors are undefined near 0 (zero) reference outputs.

Set point errors are determined using the measured DUT set point whenever possible. If a measured value is not available, the nominal value is used as the set point.

$$E_{\%DUTFS} = \frac{Q_{DUT} - Q_{Ref}}{Q_{DUTspan}} \times 100$$

$$E_{\%Rdg} = \frac{Q_{DUT} - Q_{Ref}}{Q_{Ref}} \times 100$$

$$E_{\%DUTFS\_Set} = \frac{Q_{ref} - Q_{Set}}{Q_{DUTspan}} \times 100$$

$$E_{\%Rdg\_Set} = \frac{Q_{ref} - Q_{set}}{Q_{set}} \times 100$$

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VARIABLE	DESCRIPTION
Q_{DUT}	Current DUT final output.
Q_{Ref}	Current reference final output.
$Q_{DUTspan}$	DUT span as determined by the difference between the maximum and minimum final output values in the DUT Definition.
$E_{\%DUTFS}$	DUT percent of full scale error.
$E_{\%Rdg}$	DUT percent of reading error.
Q_{Se}	Test target in DUT final output unit.
$E_{\%DUTFS\_Set}$	DUT percent of full scale set point error.
$E_{\%Rdg\_Set}$	DUT percent of reading set point error.

29.2 TOLERANCE

The determination of whether a point is in or out of tolerance depends on the type of tolerance selected, and the DUT and reference pressures. Tolerance values may be specified in multiple units (**Tolerance Choices**, 4.3.6.2.3.1). **COMPASS** first determines the tolerance value in DUT final output unit and then compares the value to the current DUT error to determine if the error is smaller (in) or larger (out) than the tolerance. When the DUT tolerance selection is (%DUTspan + %Reading) the tolerance is the sum of the two values. If the selection is %DUTspan or %Reading, the tolerance used is the greater of the two values. Tolerances that are defined in DUT final output, set, or output units are also compared directly in the test unit of measure.

$$QT_{\%DUTspan} = \frac{T_{\%DUTspan}}{100} \times Q_{DUTspan}$$

$$QT_{\%reading} = \frac{T_{\%reading}}{100} \times Q_{Ref}$$

VARIABLE	DESCRIPTION
$T_{\%DUTspan}$	%DUTFS tolerance value defined in the DUT definition.
$Q_{DUTspan}$	DUT span as determined by the difference between the maximum and minimum final output values in the DUT Definition.
$QT_{\%DUTspan}$	Maximum allowable(DUT – reference) deviation based on a %DUTFS tolerance.
Q_{Ref}	Current reference final output.
$T_{\%reading}$	%Reading tolerance value defined in the DUT definition.
$QT_{\%reading}$	Maximum allowable (DUT – reference) deviation based on a %Reading tolerance.

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29.3 BEST FIT

All best fit values in **COMPASS** are determined using the least squares method. This defines a selectable order polynomial equation that defines a line (or curve) that minimizes the sum of the squares of the distances from the calculated line (or curve) to the actual line (or curve). A set of general equations is described below. Based on the order of the polynomial fit, a system of equations is described. Solving these equations for each of the polynomial coefficients determines the resultant polynomial equation.

$$b_o n + b_1 \sum_{j=1}^{n} x_j + b_2 \sum_{j=1}^{n} x_j{}^2 + \ldots\ldots b_m \sum_{j=1}^{n} x_j{}^m = \sum_{j=1}^{n} y_j$$

$$b_o \sum_{j=1}^{n} x_j + b_1 \sum_{1\ j=1}^{n} x_j{}^2 + b_2 \sum_{j=1}^{n} x_j{}^3 + \ldots\ldots b_m \sum_{j=1}^{n} x_j{}^{m+1} = \sum_{j=1}^{n} x_j y_j$$

$$\bullet$$

$$\bullet$$

$$b_o \sum_{j=1}^{n} x_j{}^m + b_1 \sum_{1\ j=1}^{n} x_j{}^{m+1} + b_2 \sum_{j=1}^{n} x_j{}^{m+2} + \ldots\ldots b_m \sum_{j=1}^{n} x_j{}^{m+m} = \sum_{j=1}^{n} x_j{}^m y_j$$

VARIABLE	DESCRIPTION
n	Number of X and Y points taken.
m	The order of the polynomial to fit. First order m = 1, second order m=2 and so on.
b_o , b_1 ..	Polynomial fit coefficients.
x_j	X axis data. This may be either the DUT or reference pressure or output. It depends on the purpose of the best fit. Typically, it is the DUT pressure.
y_j	Y axis data. The data may be either the DUT or reference pressure or output. It depends on the purpose of the best fit. Typically, it is the reference pressure.

29.4 LINEARITY

COMPASS determines the terminal based linearity of the DUT errors relative to the reference readings. The linearity value can be included in reports.

There are two possible linearity calculations depending upon the test point sequence.

If the test point sequence is made up of corresponding ascending and descending (or vice-versa) points, linearity is calculated by taking the average between corresponding DUT pressures, drawing a straight line between the minimum and maximum DUT pressure and determining the maximum deviation of any average DUT pressure from this line. In this case, a hysteresis value is also calculated.

If the test point sequence is not made up of corresponding ascending and descending (or vice-versa) points, linearity is calculated by drawing a straight line between the minimum and maximum DUT points and determining the maximum deviation of any one point from this line. In this case, hysteresis is not calculated.

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If the minimum and maximum reference pressures in the test sequence are equal, linearity cannot be calculated and COMPASS displays <N/A> in place of a number.

29.5 HYSTERESIS

COMPASS determines the hysteresis of DUT output relative to the reference readings. The hysteresis value can be included in reports.

COMPASS first analyzes the test data to determine if a meaningful hysteresis calculation can be made. For hysteresis to be calculated, the test point sequence must correspond to a normal ascending and descending (or vice versa) calibration sequence. This means that the first and last nominal test points must be within 1% of each other as well as the second and second to last, etc. If the sequence does not meet this criterion, **COMPASS** displays **<N/A>** in place of a number. This is the same test used to determine which type of linearity calculation will be used. It is not efficient for all possible combinations of points to be verified as part of the hysteresis calculation. If hysteresis information is desired on test data that does not meet this criterion, use a macro in the report editor.

Hysteresis is the maximum difference between corresponding ascending and descending DUT points in a test point sequence. The hysteresis value is expressed in %DUTFS.

29.6 REPEATABILITY

A calculated repeatability value is only possible when multiple pressure cycles, test cycles or Data Files are used to generate a report. The value is determined by comparing data from each test cycle and finding the maximum error deviation between any two cycles at the same point. The value is expressed in %DUTFS.

29.7 MEASUREMENT UNCERTAINTY

The DUT measurement uncertainty resulting from the test is calculated as the root sum square of the various components that determine the overall system uncertainty. This includes: linearity, hysteresis, repeatability, resolution and reference uncertainty. DUT resolution is obtained from the DUT Definition. DUT linearity, hysteresis and repeatability are calculated from the test data as described in the sections above. Reference uncertainty is obtained from the Device Definition of the reference. Each of the values is converted to a single standard deviation by dividing by the appropriate value. The final measurement uncertainty value is then multiplied by 2 to obtain a coverage factor of 2. The uncertainty value is converted to %DUTFS for reporting.

The measurement uncertainty equation is described below. The calculation described determines the value in the DUT's pressure unit of measure. A full description and analysis of each of the measurement uncertainty components is beyond the scope of this manual (see ISO/TAG 4WG3 Guide to the Expression of Uncertainty Measurement). **COMPASS** determines measurement uncertainty for each test cycle individually as well as for all test data combined.

$$U_{DUT} = 2 * \sqrt{S_{EstErr} + \left[\frac{E_{resolution}}{\sqrt{3}}\right]^2 + \left[\frac{U_{std}}{2}\right]^2}$$

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VARIABLE	DESCRIPTION
U_{DUT}	Calculated DUT measurement uncertainty expressed as a value in DUT pressure units, using a coverage factor of 2. The value is reported as %DUTFS by dividing by the DUT's span and multiplying by 100.
S_{EstErr}	Standard estimate of error for a first order linear regression. This value combines linearity, hysteresis and repeatability. The value is the standard deviation of the error from a linear fit.
$E_{resolution}$	Specified DUT resolution. This value is determined by the resolution selection in the DUT Definition.
U_{std}	Uncertainty of the reference as specified in the reference Device Definition. The value is converted to the DUT's pressure unit of measure for the calculation.

29.8 PISTON GAUGE PRESSURE CALCULATIONS

The following sections document the calculations used by **COMPASS** to define the pressure of a piston gauge. When a **DHI** PG is used remotely, **COMPASS** only applies a unit conversion as necessary to convert from the PG's output unit to the display unit in **COMPASS**. The values on the following table are used to calculate the piston gauge pressure. Each of the values is specified in **COMPASS** in either the Piston-Cylinder, Mass Set or Mass Bell setups. Refer to the appropriate editor to view edit or modify a setting. The **COMPASS [Tools]**, **[Piston Gauge Calculation]** option is a simple way to verify the **COMPASS** calculation as compared to a spreadsheet or another PC based application.

Table 107. PG7000 Defined Pressure Calculation Variables

VARIABLE	DEFINITION	UNITS	SOURCE OF VALUE
$\sqrt{A_{\theta,P}/\pi}$	Piston diameter at temperature θ and pressure P	m	Calculated.
$A_{20,0}$	Piston effective area at 20°C, P_{atm}	mm^2	Piston-Cylinder definition
$A_{\theta,P}$	Piston effective area at temperature θ, pressure P	m^2	Calculated from $A_{20,0}$ in Piston-Cylinder definition.
G	Local gravity	m/s^2	Local gravity specified in **[Tools]**, **[Options]**, **[Piston Gauge]**
K_N	Nominal mass to pressure conversion coefficient for a given piston-cylinder size	Pa/kg	Calculated from $A_{20,0}$ and standard conditions.
M	Mass load	kg	Current mass load.
P_A	Absolute pressure	Paa	Calculated.
P_{atm}	Atmospheric (ambient) pressure	Paa	Internal measurement, user entered value or constant as specified in **[Tools]**, **[Options]**, **[Ambient Conditions]**.
P_G	Gauge pressure	Pa	Calculated.
P_{HA}	Fluid head correction in absolute mode	Pa	Calculated using the specified head height and medium.
P_{HG}	Fluid head correction in gauge mode	Pa	Calculated using the specified head height and medium.
P_{HD}	Fluid head correction in high line differential mode	Pa	Calculated using the specified head height and medium.
P_L	Line Pressure	Pa	High line differential mode only.
P_{nom}	Nominal pressure	Pa	In pressure to mass mode $P_{nom}=P_{req}$ In mass to pressure mode $P_{nom}=M \cdot K_N$
ΔP_D	Differential pressure	Pa	Calculated differential pressure in differential measurement mode only.
	Surface tension coefficient	N/m	Piston-Cylinder definition.
α_C	Cylinder linear thermal expansion coefficient	$°C^{-1}$	Piston-Cylinder definition.
α_P	Piston linear thermal expansion coefficient	$°C^{-1}$	Piston-Cylinder definition.
	Piston-cylinder pressure coefficient	Pa^{-1}	Piston-Cylinder definition.

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VARIABLE	DEFINITION	UNITS	SOURCE OF VALUE
	Temperature of piston-cylinder	°C	Internal measurement or user entered value as specified by the test initialization.
ρ_a	Air density	kg/m^3	Calculated from standard air density corrected for actual atmospheric pressure, ambient temperature and relative humidity (atm p, humidity and temp source are specified by SETUP file).
ρ_m	Mass density	kg/m^3	Mass Set definition.

29.8.1 GAUGE MODE:

$$P_G = \frac{Mg\left(1-\frac{\rho_a}{\rho_m}\right)+2\pi\sqrt{\frac{A_{\theta,P}}{\pi}}\Gamma}{A_{\theta,P}} + P_{HG}$$

$$A_{\theta,P} = A_{20,0}\cdot 10^{-6}\cdot\left[1+(\theta-20)(\alpha_P+\alpha_C)\right](1+\lambda P_{nom})$$

29.8.2 ABSOLUTE PRESSURE BY ADDING ATMOSPHERIC PRESSURE:

$$P_A = \frac{Mg\left(1-\frac{\rho_a}{\rho_m}\right)+2\pi\sqrt{\frac{A_{\theta,P}}{\pi}}\Gamma}{A_{\theta,P}} + P_{HA} + P_{atm}$$

$$A_{\theta,P} = A_{20,0}\cdot 10^{-6}\cdot\left[1+(\theta-20)(\alpha_P+\alpha_C)\right](1+\lambda P_{nom})$$

29.8.3 ABSOLUTE PRESSURE WITH VACUUM REFERENCE:

$$P_A = \frac{Mg+2\pi\sqrt{\frac{A_{\theta,P}}{\pi}}\Gamma}{A_{\theta,P}} + P_{HA} + P_{vac}$$

$$A_{\theta,P} = A_{20,0}\cdot 10^{-6}\cdot\left[1+(\theta-20)(\alpha_P+\alpha_C)\right](1+\lambda P_{nom})$$

29.8.4 DIFFERENTIAL PRESSURE (DIFFERENTIAL MODE):

$$\Delta P_D = \frac{Mg+2\pi\sqrt{\frac{A_{\theta,P}}{\pi}}\Gamma}{A_{\theta,P}} + P_{HA} + P_{vac} - P_{RPM} - P_{offset}$$

$$A_{\theta,P} = A_{20,0}\cdot 10^{-6}\cdot\left[1+(\theta-20)(\alpha_P+\alpha_C)\right](1+\lambda P_{nom})$$

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29.9 FLUID HEADS

29.9.1 FLUID HEAD COMPONENTS

COMPASS supports three different fluid head components: DUT head, ATM head and Piston head. The three components are combined to create the overall head correction for each Piston Gauge pressure according to the active pressure measurement mode.

DUT head Calculates and applies a fluid head correction to predict the defined pressure at a level other than the Piston Gauge's reference level. The reference level is typically marked on the Piston Gauge platform. This is the location on the Piston Gauge in which the pressure is defined by the force of the mass load on the effective area of the Piston-Cylinder. Refer to the Piston Gauge documentation for this location.

The DUT head is calculated following:

$$P_{H_{DUT}} = (\rho_f - \rho_a) g h_D$$

Where:

$P_{H_{DUT}}$, DUT head [Pa] = Fluid head correction applied to the defined pressure calculated at the Piston Gauge reference level.

ρ_f, fluid density [kg/m^3] = density of the pressurized medium. The medium may have a fixed density or a density that is dependant on the current ambient conditions. The **<Dynamic Density Compensation>** option of the **<Pressure Medium Editor>** determines if the density is fixed at a given value or changes with ambient conditions. Typically hydraulic media remain constant and gaseous media are changed with ambient conditions.

ρ_a, air density [kg/m^3] = Density of ambient air calculated using current ambient pressure, temperature and relative humidity. Assumed to be zero when operating in absolute with a vacuum reference mode.

g, gravity [m/s^2] = Acceleration due to local gravity as specified in **[Tools][Options][Piston Gauge]**.

h_D, DUT height [m] = Height of DUT above the Piston Gauge reference level. Value is negative if below reference level.

ATM head Calculates and applies a fluid head correction to internal or external barometer readings to correct the atmospheric pressure value to the Piston Gauge's reference level if the barometer is reading at a different level than the Piston Gauge. See section for ATM head height information.

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The ATM head is calculated following:

$$P_{H_{atm}} = \rho_{as} g h_B$$

Where:

$P_{H_{atm}}$, ATM head [Pa] = fluid head correction applied to the internal or external barometer reading.

ρ_{as}, air density [kg/m3] = standard air density of 1.2 kg/m3.

g, gravity [m/s2] = acceleration due to local gravity.

h_B, barometer height [m] = Height of the internal or external barometer above the Piston Gauge reference level. Value is negative if below the reference level of the Piston Gauge.

PISTON head Calculates and applies a fluid head correction to compensate for the difference between the current measured piston position and the Piston Gauge reference level. This correction is not applied when the piston position is not measured. The ability to measure the Piston Position is determined by settings in the **<Piston Gauge Platform Editor>** and in the Test Initialization.

The DUT head is calculated following:

$$P_{H_P} = \left(\rho_f - \rho_a\right) g h_P$$

Where:

P_{H_P}, Piston head [Pa] = fluid head correction applied to calculate defined pressure.

ρ f, fluid density [kg/m3] = Density of test fluid at current pressure.

ρ a, air density [kg/m3] = Density of ambient air calculated using current ambient pressure, temperature and relative humidity. Assumed to be zero when operating in absolute with a vacuum reference.

g, gravity [m/s2] = Acceleration due to local gravity.

h_P, piston height [m] = Height of the current piston position above Piston Gauge reference level.

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29.9.2 OVERALL FLUID HEAD CORRECTION

The overall fluid head correction results from combining the three head components for each Piston Gauge measurement mode. In general, overall head correction is given by:

$$P_H = -P_{H_{DUT}} - P_{H_{atm}} + P_{H_P}$$

Gauge mode:

$$P_{HG} = -(\rho_f - \rho_a)gh_D - \rho_a gh_B + (\rho_f - \rho_a)gh_P$$

Absolute mode by adding atmospheric pressure:

Air density is zero for all components except for the ATM head, which is used to compensate for barometer height.

$$P_{HA} = -\rho_f gh_D - \rho_{as} gh_B + \rho_f gh_P$$

Absolute mode with vacuum reference:

Air density is zero for all terms and no barometer is used.

$$P_{HA} = -\rho_f gh_D + \rho_f gh_P$$

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30. TROUBLESHOOTING

COMPASS for Pressure is a sophisticated software package with many advanced features with the potential to be misused and/or misunderstood. Check the **How Do I?** section of this manual for an explanation on how to properly use **COMPASS** for several common applications as well as quick tips on how to use many features. Before assuming that unexpected behavior is caused by a software or hardware defect, the operator should use this manual in conjunction with the documentation on other devices used with **COMPASS** to troubleshoot and identify normal behavior.

The following section contains suggestions and solutions to resolve many commonly encountered issues. Identify the unexpected behavior from the symptoms list in **Table 108**. A Probable Cause and Solution are proposed including cross references to sections in this manual that may be of assistance.

When communicating with a DHI technical service representative, it is best to note the specific COMPASS behavior and the steps used that led to that behavior. Attempting to diagnose the problem prior to communicating this behavior frequently delays the resolution of the problem.

Table 108. Troubleshooting

SYMPTOM	PROBABLE CAUSE	SOLUTION
The test report logs N/A as the hysteresis value.	Ascending and descending points must agree within 1 % to determine a hysteresis value.	Define a test that has identical ascending and descending test points.
A test runs but all DUT final outputs and/or output values are 0.00 or another unexpected value.	The DUT's specified **<Process Command>** or **<Manipulate Response>** entry is incorrect when the DUT data acquisition is RS232 or IEEE-488.	Use **[Tools]**, **[Remote Communications]** to send discrete commands to verify the command being used by the DUT or DMM, then make the appropriate edits to the DUT or DMM setup. Refer to the documentation of the data acquisition device for command details.
	The DMM used to read the DUT output has an incorrect **<Process Command>** or **<Manipulate Response>** entry. This is only possible when the DUT data acquisition requires a DMM.	
A **COMPASS** time-out occurs when reading a device during test initialization. This can occur when using any supported device.	The device interface is not properly set up.	Always make sure a device is powered ON and has the remote interface cabling securely attached prior to use. The remote interface settings of all supported devices can be adjusted in their respective setups. Make sure that the **<Read Response>** button is not checked when a remote command does not respond.
	The RS232 or IEEE-488 interface cable is not secure.	
	A device command is used that does not respond.	
	The device power is not ON.	
When using a **DHI** pressure controller or reference to run a test, the reference Ready indicator is always red though the output appears very stable.	The Test Definition stability or hold limit in the test results in a stability limit that is too small for the current test conditions.	Use the **Test Editor [Set]** tabs to change the stability and hold limit values as required to yield a stable output. PPC2+, PPCK+ and PPC3 pressure controllers use default stability criterion after changing ranges. Enter 0s for the stability and hold values to allow the PPCs to use their default settings.
When output regulation is active, the regulated output oscillates significantly around the target.	The regulation time is too small.	Make sure the gas supply is sufficient for the current test and that the controller has the proper performance. Use the **Test Editor** to change the regulation limit in the test.
	The gas supply is running out causing faulty control.	
	The target output is not within the resolution of the controller.	
When initializing a test, an error displays because a device cannot	The device was permanently deleted from the database.	Devices removed from the **COMPASS** database cannot be retrieved. However, if

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SYMPTOM	PROBABLE CAUSE	SOLUTION
be located in the **COMPASS** database.	The wrong **COMPASS** database is in use.	the wrong database is in use, use the **[Database]**,**[Setup]** option to specify the correct database.
The output of my PPC is changing erratically in **COMPASS** yet my pressure is stable.	Interface is not properly buffered by the operating system.	This issue is typically associated with the Windows NT operating systems. If this is the case, open **Control Panel** then select **Ports**. Select the effected RS232 port from the list then choose **Settings**. Change the state of the **FIFO Enabled** option at the bottom of the **Settings** display.
	The RS232 cable is not properly grounded.	Check the RS232 cable to make sure that all pins are properly connected. Especially pin 5 (ground).
	The PC's RS232 port is going bad.	However rare, RS232 ports do go bad. This problem is associated with intermittent communications. Verify that other RS232 devices function properly while being continuously polled.
I cannot edit a Test Definition, Piston Gauge Platform, Hardware profile, etc.	The user rights associated with the current user login do not permit the selected edits.	Login as a user with more user rights by using **[Database]**, **[Change Current User]** or have a user with administrator level access adjust your user rights.
I cannot edit a selected Test Definition during the initialization of a test.	**COMPASS** displays Test Definitions in **Test Editor** for viewing purposes only during test initialization and while a test is running.	Edit tests using **[Setup], [Test]** while **COMPASS** is idle to edit a Test Definition.
The test Data File appears in the **COMPASS** root directory as opposed to a directory based on the DUT serial number or identification.	An invalid character appears in the DUT serial number or ID field: **/**, ****, **?**, **:**, *****, **<**, **>**, **|**, or **"**. These characters cannot be used in file or directory naming in Windows.	Use the DUT Editor to remove any invalid characters in the DUT Definition serial number or ID field. Make sure these characters are not entered during the **<Setup DUT(s)>** step of test initialization.
	The target directory for Data Files has restricted access or does not exist. **COMPASS** always defaults to the root directory without generating an error when trying to create test Data Files.	Use Windows Explorer to verify the Data File directory selection on **[Tools]**, **[Options]**, **[Data File]** tab is valid.
Data Files are not being stored to the right directory.	Data Files are stored under the Data File name and the directory path specified. You may not be looking in the correct directory path.	Familiarize yourself with the Data File naming and storing protocol. Also consider that the **COMPASS** main program and the **COMPASS Report Editor** may be specifying two different default directory paths.
The front panel of my device displays more resolution than the main run screen of **COMPASS**.	The output resolution selection in the device's (or DUTs) Device Definition is less than the actual device resolution.	Use the appropriate hardware Editor to change the **<Final Output Resolution>** field.
When running **COMPASS**, the front panel of a device used by **COMPASS** is not displaying the same unit as on the **COMPASS** run screen. When I change units in **COMPASS**, my device units do not change.	**COMPASS** does not modify the display unit of devices used by **COMPASS**. Including **DHI** products. The device display unit active during test initialization will remain active for the duration of the test. Except when using a PPC or RPM3 that has changed range. In this case, the unit may change since PPCs and RPM3 maintain independent display units for each range.	This is normal **COMPASS** behavior. To change the device display unit, change it on the devices front panel. **DHI** devices require no further setup. However, non **DHI** devices must output in their configured **<Raw Output Unit>**. Changing the device front panel unit frequently requires the devices Device Definition to be edited to use the selected display unit.

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SYMPTOM	PROBABLE CAUSE	SOLUTION
The run screen display unit in **COMPASS** is the same as the display unit of my device, but the numbers are not the same.	The device output is being manipulated by the **<Raw Output to Final Output Relationship>**.	Make sure that the output manipulation is intended and correct.
	A pressure head correction is being applied to the output. This applies for non **DHI** references only when the head correction height <> 0.	Use 0 as the head correction height to prevent **COMPASS** from performing a head correction on non **DHI** pressure references.
	The device's remote output unit is not the same as the **<Raw Output Unit>** on the **<Output Relationship>** setup.	Refer to the device's operation manual for instructions on changing the display and/or remote interface output unit of a device. If possible, use initialization commands to set a device to the required **<Raw Output Unit>**. This prevents front panel changes from affecting the **COMPASS** setup.

30.1 ERROR LOG

Each time **COMPASS** runs a test an error log file is created. Specific error information is written to this file when errors occur in **COMPASS**. This includes, remote communications errors, macro errors, control timeout errors ect. In the event an automated test fails for reasons unknown, always refer to this file. If a new test is started, the old error log file is erased and a new error log file is created. So do not start a new test until the error log file is checked if a problem occurs.

The file is named CompErrs.log and is stored in the root directory of the **COMPASS** program. Typically this is "C:\Program Files\COMPASS for Pressure".

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31. GLOSSARY

-9999	This is an invalid numeric data flag used by **COMPASS**. The value is written to data files but not displayed throughout the program. For example a % of reading error with a 0 reference pressure will log this value in the data file. A report that uses the data file will list "N/A" and not this invalid number flag.
Absolute	As in "absolute pressure". Pressure expressed relative to vacuum.
Absolute by ATM	Absolute pressure determined by adding atmospheric pressure to gauge pressure.
Absolute by vacuum	Absolute pressure determined by defining pressure relative to vacuum in an evacuated bell jar (PG7601 only).
Adder	A value added to internal sensor readings to offset the readings (pressure adder, temperature adder, humidity adder, vacuum adder) for calibration adjustment.
Ae	Piston-cylinder effective area.
ATM Head	Pressure head correction to the barometer measurement to take into consideration the difference between the actual barometer level and the PG7000 reference level.
Averaging Time	The time over which reference and DUT readings are taken at a point in a **COMPASS** run mode. **COMPASS** makes as many readings as possible during the averaging time and then averages the readings to arrive at the reference and DUT reading for the test point.
DAQ	The short form of Data Acquisition. This refers to the method used to gather data from a DUT.
Data Acquisition Type	How data is acquired from a device (e.g. RS232, IEEE-488, manual, TCP/IP). Found on the DUT or Device Editor, Communication tab.
Data File (*.dat)	Files automatically created by **COMPASS** to store the data from a test.
Data Type	Field in a Data File.
Deadweight Tester	Each mass has a pressure value for a specific gravity.
Default Hardware Configuration	The selection of default sources for final outputs used by **COMPASS**. Is selected by Final Output, not by Device. See also Test Hardware Configuration.
Definition	Probably needs to be defined by itself, as in DUT Definition, Test Definition, Platform, P-C, mass set, bell…
Device	Hardware component or device. DUTs, piston gauges and support devices are all Devices. A device may have multiple Raw and Final Outputs.
Device Definition	The record in the DUT, piston gauge or support device database of a specific device available for use by **COMPASS.** The Device Definition defines the device including manufacturer, serial number ID and interfacing details. Device Definitions are selected to put together the Default Hardware Configuration that specifies the default source of final outputs used by **COMPASS t**o run tests.
Device Editor	Say what it is and that it is only DUTs, platforms and support devices.
Differential	As in differential pressure. Pressure expressed relative to atmospheric or another static pressure determined by subtracting the static pressure from absolute by vacuum (differential measurement mode).
DMM	Digital multimeter. Used by **COMPASS** to read the electrical outputs.
DUT	Device Under Test, Test Device (TI), Unit Under Test (UUT). The device that is being tested using **COMPASS**. DUTs are defined in DUT Definitions.
DUT Definition	The record in the DUT database in which **COMPASS** stores DUT information. Defines the DUTs that are tested by **COMPASS**.
DUT Profile	A type of DUT Definition that is intended to define a *type* of DUT. This is a generic definition that does not include serial number or ID or specific range information. Can be used to test any DUT of a specific type. Frequently used to test multiple DUTs that are specifically identified at the time of the test. See also Individual DUT.
DUT Tolerance	The performance limit of a DUT expressed in terms of maximum allowable disagreement with the reference. DUT tolerance may be expressed in pressure units, as a % of DUT FS, as a % of reading or as a combination.
Dwell	A waiting period at a test point between the time the target is set and stabilized and the start of data acquisition to take the DUT and reference readings at the test point.

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Dynamic Data	Data recorded at each point during a test.
Error	The disagreement between the DUT indication and the reference indication. The error is always calculated using (DUT – reference).
Final Output	Formerly known as Measurand. This is the Output Type, designated for a specific function in **COMPASS**. (e.g. Pressure is an output type, Pressure output type can be Final Outputs of Ambient Pressure, DUT Pressure, Vacuum Pressure, General Pressure, Humidity is an output type, Humidity can only be Humidity)
Final Set	Set equivalent of Final Output.
FS (Full Scale)	The full scale value is the maximum value or the span of a measurement range. Limits and specifications are often expressed as % FS.
g, gl	Acceleration due to gravity (g). Acceleration due to gravity at location of use (gl).
Gauge	As in gauge pressure. Pressure expressed relative to atmospheric pressure.
Global Variable	Variable declared before the first function in any **Global Macro**. All functions within any macro type can use this variable.
HART	Acronym for Highway Addressable Remote Transducer. This is a popular communications and hardware protocol developed by Rosemount in 1986. This command protocol modulates a frequency signal on top of a 4-20mA current output. A series of standard command are defined for all devices that support this protocol. Many of these commands can be used by **COMPASS**. Visit www.Hartcomm.org for details on this protocol.
Hardware Component	Or Device = Device or Support Device
Head	Fluid head correction to the pressure defined by a reference to predict the pressure at the level of the DUT, which may be different from the pressure reference.
	As in high line differential pressure measurement mode. Pressure expressed relative to a line pressure greater than atmospheric pressure. Defined by using two piston gauges.
Individual DUT	A type of DUT Definition that is intended to define a *specific* DUT including its serial number and ID. Individual DUT Definitions can only be used to test one specific DUT. See also DUT Profile.
InHg	Pressure unit of measure, inches of mercury.
InWa	Pressure unit of measure, inches of water.
	Adjust an output slightly at a particular point. Jog is most often used when testing visual output devices such as pressure gauges to set the pressure so that the DUT indication is on the nominal pressure point prior to taking data at the point. **COMPASS** Test Definitions allow "jog before dwell" to be included in the test procedure.
Kcm2	Pressure unit of measure, kilogram per centimeter square.
Leak Check	A process in which a pressure is set in the test system and then allowed to evolve freely. The decay rate of the pressure over time is used as an indication of the leak present in the system. **COMPASS** Test Definitions can include a leak test at the start of the test.
Line Pressure	Pressure on the low side in high line differential pressure measurement mode. Pressure relative to which the differential pressure is defined.
Local Variable	Any variable created within a macro function. No other macro function read or set the data held by these variables.
Manual Control	Indicates, in a Test Definition, that the output *will not* be controlled in response to remote commands sent by **COMPASS.** When running a test, **COMPASS** will therefore prompt the user to set the output at each point.
Mass Bell	The sleeve loaded onto the piston to carry other masses.
Mass Set (MS)	A group of masses composed for use with a PG7000 piston gauge.
Mass Entry Mode (mass to pressure)	Operating mode in which the user enters the mass loaded on the piston and **COMPASS** calculates the defined pressure. See also Pressure Entry Mode.
Measurement Mode	Mode in which pressure is defined. These include gauge (pressure relative to atmospheric pressure), absolute by atmosphere (pressure relative to vacuum determined by adding atmospheric pressure to gauge pressure), absolute by vacuum (pressure relative to absolute vacuum determined by establishing a vacuum around the mass load), differential (PG7601 only) (pressure relative to atmospheric or another static pressure determined by subtracting the static pressure from absolute by vacuum).
Medium, pressurized	The pressurized fluid.
Module Variable	Variable declared before the first function in any macro. All macros of the same macro type can use this variable.
	A value by which internal sensor readings are multiplied to change their slope (pressure multiplier, temperature multiplier, humidity multiplier, vacuum multiplier) for calibration adjustment.
Multiplexer	Device that handles signal switching for a measuring device. The multiplexer switches channels to allow the measurement of an individual device output as required for testing.

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N2	Nitrogen gas.
Nominal Mass	The mass loaded on the piston in terms of the nominal values written on the individual masses. See also True Mass.
Normal	A conventional or standard value.
Editor	
Output Source	Where data will come from (e.g. the Data Acquisition Type specified for the device or a different Final Output). Found on the Output Relationship Editor, **[Raw Output]** tab.
Output Type	Defines the nature of the output of a device (i.e. Current, Frequency, Humidity, Position, Pressure, Resistance, Rotation, Temperature, User Defined, Voltage). All Final Outputs are a "sub-category" of Output Type. This is really a classification convenience to avoid having to deal with the complete, long list of final outputs all the time. See also Set Types. There is an Output Type on the Output Relationship Editor, **[Raw Output]** tab to define the type of raw output and there is an Output Type on the Final Output Tab to define the type of the Final Output. When relationship of Raw Output and Final Output is **<SAME>**, then Output Type of the Final Output is fixed to be same as Raw Output Type.
PC	Piston-cylinder, piston-cylinder module.
PG7000	Generic representation of the entire line of **DHI** 7000 series Piston Gauges: PG7601, PG7102, PG7601, PG7302.
Physical Targets	
Piston-Cylinder (PC)	Piston-cylinder, piston-cylinder module.
Piston Gauge (PG)	Abbreviation of piston gauge. calculate pressure from Ae and mass
Pressure Cycle	A complete set of all pressure points in a **COMPASS** Test Definition. Tests may include multiple pressure cycles.
(pressure to mass)	Operating mode in which the user enters the pressure to be defined and **COMPASS** calculates the mass to load.
Primary Variable	The designation of the main output of a transmitter using the HART protocol. This is the output obtained by sending Universal HART command 1.
PRT	Platinum Resistance Thermometer. The element used in the piston-cylinder mounting post to measure temperature.
Raw Output	The fundamental/basic output of a device. For example, a pressure transducer's raw output is voltage and voltage is converted to its Final Output Type, pressure (then pressure is a Final Output such as DUT Pressure).
Ready/Not Ready	Indication of when conditions are present to make in tolerance pressure definitions based on specific criteria for each condition.
Ready/Not Ready	Indication of when conditions are present to make in tolerance pressure definitions based on specific criteria for each condition.
Ready/Not Ready	Indication of when conditions are present to make in tolerance pressure definitions based on specific criteria for each condition.
Reference	Device that outputs reference pressure.
Reference Level	Height at which pressures are defined. PG7000 defines pressures at its reference level. Fluid head corrections correct the pressure relative to the reference level.
Regulation	The ability to use a controller to set a target based on the measurement of another device. This is commonly used when the absolute measurement capabilities of the controller are poor relative to the absolute measurement capabilities of the reference.
RPT	Reference Pressure Transducer. The pressure transducers used in a DH Instruments PPC3 are referred to as RPTs.
	Acronym for Standard Commands for Programmable Instruments. This is a common remote command protocol used instruments. Many DMM and multiplexers use this command protocol.
Set, Final Set	
Set Types	Defines the nature of the set of a device (i.e. Current, Driver, Mux Channel, Pressure Temperature, User Defined, Voltage). All Final Set s are a "sub" of Set Types. See also Output Types.
Span	The difference between the minimum and the maximum DUT input or output. Often referred to as full scale but more meaningful than full scale for DUTs whose minimum output is not zero.
State Targets	
Stability	Rate of change of an output per second.
Stability Limit	A limit expressed in units of an output (pressure, temperature, etc.) per second (e.g., psi/second). The stability limit is used by **DHI** products and is applied to non **DHI** products in **COMPASS** Test Definitions.

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Static Pressure	Pressure on the low side of a Piston Gauge in differential mode.
Support Device	Any piece of hardware (device) that is NOT a DUT or a PISTON GAUGE.
Test Cycle	A complete set of all points in a test definition. A test cycle may be repeated. A test with multiple test cycles is called a Complete Test Cycle. A Test Cycle includes: Pressure Cycle: the sequence of pressure points, e.g. 0, 20, 40, 60, etc. The pressure cycle may be repeated. Line Pressure Cycle: the sequence of line pressures. The pressure cycle, or multiple cycles if specified, is run at each line pressure. Temperature Cycle: the sequence of temperatures. The line pressure cycle, including the pressure cycle(s) is run at each temperature in the sequence. The Test Cycle may be repeated. A Complete Test Cycle, includes all repetitions of the Test Cycle.
Test Definition	A database record, which defines all the aspects of a test procedure that **COMPASS** can run on a DUT. Test Definitions can be associated with DUTs and control the test procedure when a test is run.
Test Hardware Configuration	The selection of sources for final outputs used by **COMPASS** to run a specific test (seen during test initialization). Shows only the outputs needed to run the test as specified in the Test Definition. Does not include DUT needed devices as they are handled with the DUT. See also Default Hardware Configuration.
Tolerance	Same as DUT tolerance.
True Mass	The actual mass loaded on the piston using the measured value of each mass. See also Nominal Mass.
Trim Mass Set	Mass set used with piston gauges consisting of masses of less than 100 g whose true values are equal to their nominal values. Trim masses are generally used in combination with the regular mass set to set a target mass value exactly.

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